United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Ohio Department of
Natural Resources,
Division of Soil and Water
Conservation, and Ohio
Agricultural Research and
Development Center

# Soil Survey of Brown County, Ohio

# How To Use This Soil Survey

## General Soil Map

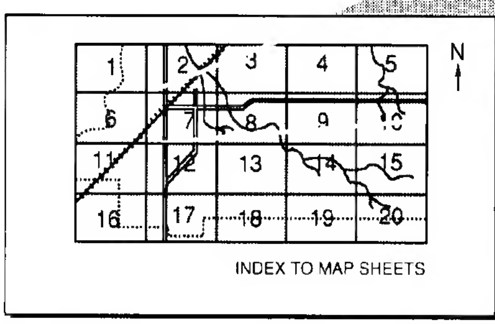
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

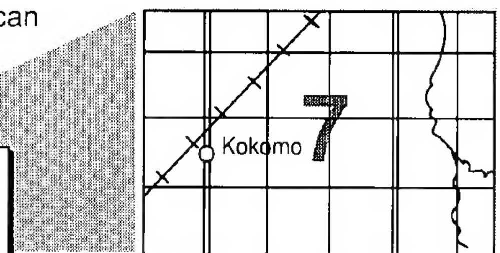
## Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.

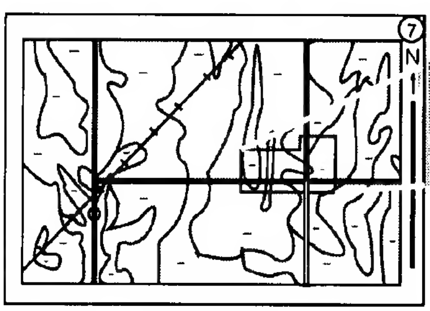


INDEX TO MAP SHEETS

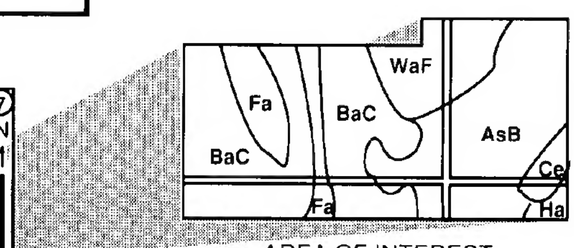


MAP SHEET

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1985. Soil names and descriptions were approved in 1987. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1987. This survey was made cooperatively by the Soil Conservation Service; the Ohio Department of Natural Resources, Division of Soil and Water Conservation; and the Ohio Agricultural Research and Development Center. It is part of the technical assistance furnished to the Brown County Soil and Water Conservation District. Financial assistance was provided by the Brown County Commissioners.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

**Cover: An area of Genesee soils used for tobacco, which is the major source of farm income in the county.**

# Contents



Issued July 1992

# Index to Map Units

# Summary of Tables

# Foreword

This soil survey contains information that can be used in land-planning programs in Brown County, Ohio. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are moderately deep to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table near the surface makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Joseph C. Branco
State Conservationist
Soil Conservation Service

# Soil Survey of Brown County, Ohio

By N.K. Lerch, Soil Conservation Service

Fieldwork by N.K. Lerch and D.R. Michael, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
the Ohio Department of Natural Resources, Division of Soil and Water Conservation, and
the Ohio Agricultural Research and Development Center

Brown County is in the southwestern part of Ohio, directly north of the Ohio River (fig. 1). It is the third county east of the Indiana State line. It has an area of 313,856 acres, or about 496 square miles. Georgetown, the county seat, is in the south-central part of the county. It is about 40 miles southeast of Cincinnati. In 1980, the population of the county was 31,920.

The landscape in the county includes very broad flats in the northern part and very steep hillsides in the southern part. In general, the steeper slopes are in the most dissected areas near the major deep drainageways, such as the Ohio River, Three Mile Creek, Eagle Creek, Straight Creek, and White Oak Creek.

The county is mainly rural. It has only a few industries, which tend to be small. There is a considerable amount of urban pressure from the greater Cincinnati area.

This soil survey updates the survey of Brown County published in 1936 *(7)*. It provides additional information and has larger maps, which show the soils in greater detail.


**Figure 1.—Location of Brown County in Ohio.**

## General Nature of the County

This section gives general information about the county. It describes settlement; geology; physiography, relief, and drainage; agriculture; and climate.

### Settlement

Native American Indians were the first inhabitants of the survey area. They inhabited the area when nearly

all of the acreage was woodland. Numerous artifacts still remain in all areas of the county. Also, there are a few Indian mounds.

Settlement began in the latter part of the eighteenth century. The early settlers came chiefly from other states to the south and east. They established themselves in areas along the Ohio River, near the mouths of its tributaries. By 1805, most of the choice tracts in these areas were occupied. As late as 1828, however, large tracts of the flatter, wetter lands to the north remained unsurveyed and unoccupied. The settlers cleared trees from the land for plowing and farming.

Brown County was organized in 1818 from parts of Adams and Clermont Counties. It is now divided into 16 townships. It was named for General Jacob Brown, who defeated a British army in the Battle of Lundy's Lane during the Revolutionary War *(9)*.

## Geology

At one time, all of Brown County was covered by a relatively shallow ocean. Marine creatures settled to the floor of this ocean, forming hundreds of layers of limy sediments. These sediments eventually turned into a hard, highly fossiliferous limestone bedrock, which underlies all of the county. The bedrock material was deposited during Ordovician times, roughly 400 million years ago. The bedrock consists of thin, alternating layers of hard fossil limestone and relatively soft, gray shale (fig. 2). After the bedrock material was deposited, the ocean floor was lifted high above the water level. Subsequently, natural water erosion carved out many stream valleys.

The Kope Formation directly underlies the soils on the lower and middle parts of valley slopes in the southern part of the county. It is made up mostly of shale.

The depth to unweathered bedrock in the county typically ranges from 20 inches to about 40 feet. In many parts of the county, the bedrock is shallow enough to limit home construction, road building, the installation of septic systems, the construction of ponds, and other activities involving excavation.

The survey area was glaciated more than once. The southeastern part of the county, however, was not covered by the glaciers, which entered the county from the north. The next to the last glacier that covered Ohio was the Illinoian glacier. It entered the county about 200,000 years ago. The glaciers left deposits of glacial till over the majority of the county. This till is typically a very compact mixture of sand, silt, clay, rocks, and boulders and has a high content of lime. It generally has some sandy or gravelly seams. When the glaciers retreated, meltwater deposited sandy and gravelly material along the larger stream valleys. These areas still stand as benches below the stream valley walls and above the current flood plains.

After the retreat of the glaciers, windblown dust was deposited in the county. This dust is called loess. It has a high content of silt, a low content of sand, and no pebbles. Originally, it had a very high content of lime, but weathering has leached out the lime. The upper part of most of the soils in the county formed in about 2 feet of loess. Since glacial times, natural erosion has continued to form deeper stream valleys. It has removed the loess from many of the steep and very steep slopes. Current streams have deposited sediments on nearly level flood plains that are parallel to one another.

Because of plowing and overgrazing, erosion has removed all of the loess from some of the less sloping areas in the county, exposing the glacial till. Therefore, in parts of some fields, numerous glacial rock fragments are on the surface.

## Physiography, Relief, and Drainage

The surface relief in the uplands in Brown County is that of a broad plain that has been dissected by numerous streams. Sloping to very steep soils are dominantly near small and large stream valleys. Broad areas of nearly level soils are generally not close to the stream valleys. Significant rises or knolls are quite rare in the areas away from stream valleys.

Elevation ranges from about 1,120 feet above sea level near Ash Ridge to about 463 feet, which is the water level of the Ohio River. Most of the changes in relief occur along stream valleys.

The Ohio River borders the southern edge of the county. All of the surface water in the county eventually drains into the Ohio River. Several tributaries, including the East Fork of the Little Miami River, White Oak Creek, Red Oak Creek, Straight Creek, and Eagle Creek, collect water from smaller streams and from ditches before entering the Ohio River.

Brown County is in two major land resource areas. In the southern part of the county, adjacent to the Ohio River, a belt about 6 miles wide is in the Kentucky Bluegrass area, and the rest of the county is in the Southern Illinois and Indiana Thin Loess and Till Plain area *(14)*.

## Agriculture

Agriculture is a major industry in Brown County. In 1984, the county had 1,890 farms, which averaged about 120 acres in size. About 227,000 acres, or more

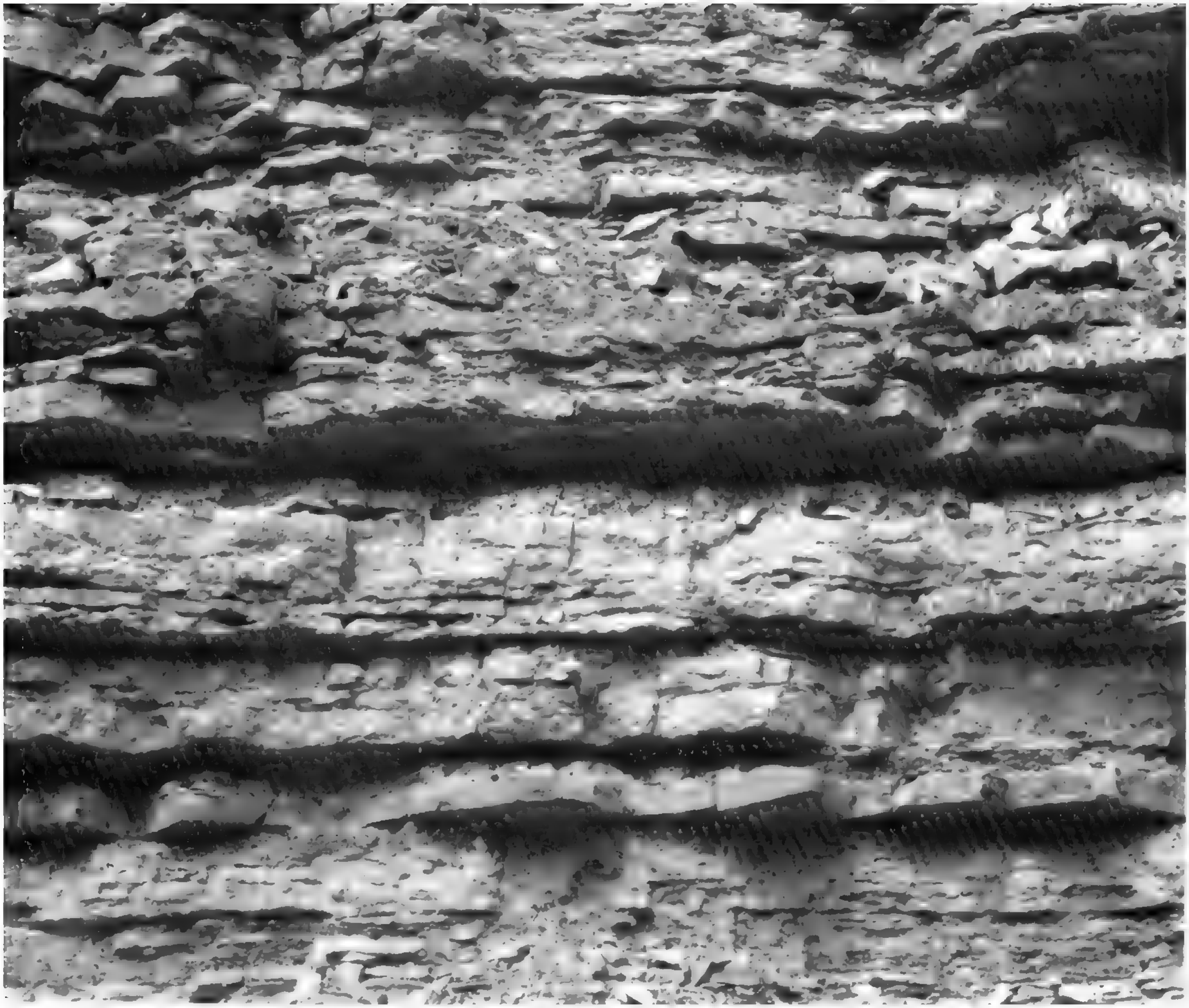


**Figure 2.—Ordovician limestone and soft shale bedrock. This bedrock is exposed in many road cuts and on steep hillsides in Brown County.**

than 72 percent of the total acreage, was farmland *(5)*.

Cash crops, such as burley tobacco, soybeans, corn, and wheat, and livestock, especially hogs, dairy and beef cattle, and calves, are the most important farm commodities. In 1983, the cash receipts from farm marketing in the county totaled $38,595,000 *(5)*. By percentage of total farm sales, the major commodities were burley tobacco, soybeans, corn, hogs, wheat, oats, and hay.

In 1984, about 40,000 acres in the county was used for corn, which yielded 4,640,000 bushels, or an average of 116 bushels per acre; 45,200 acres was used for soybeans, which yielded 1,490,000 bushels, or an average of 33 bushels per acre; 9,000 acres was used for wheat, which yielded 297,000 bushels, or an average of 33 bushels per acre; and 3,200 acres was used for burley tobacco, which yielded 8,352,000 pounds, or an average of 2,610 pounds per acre *(5)*. Brown County led all other tobacco-raising counties in the state in 1984, accounting for 34 percent of the

tobacco produced in the state *(15)*. The tobacco is cured in open barns (fig. 3).

## Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

Brown County is cold in winter and quite hot in summer. Winter precipitation, frequently in the form of snow, results in a good accumulation of soil moisture by spring and minimizes drought during summer on most soils. The normal annual precipitation is adequate for all of the crops that are adapted to the temperature and growing season in the county.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Ripley, Ohio, in the period 1959 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 32 degrees F and the average daily minimum temperature is 23 degrees. The lowest temperature on record, which occurred at Ripley on January 17, 1977, is -20 degrees. In summer, the average temperature is 72 degrees and the average daily maximum temperature is 83 degrees. The highest recorded temperature, which occurred on August 3, 1964, is 101 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, about 25 inches, or nearly 60 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 21 inches. The heaviest 1-day rainfall during the period of record was 4.77 inches at Ripley on August 26, 1971. Thunderstorms occur on about 50 days each year.

The average seasonal snowfall is about 23 inches. The greatest snow depth at any one time during the period of record was 21 inches. On the average, 23 days have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 65 percent of the time possible in summer and 45 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 11 miles per hour, in spring.

Tornadoes and severe thunderstorms occur occasionally. These storms are usually local in extent and of short duration. They cause damage in scattered small areas.

# How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to

**Figure 3.—An open barn used for curing tobacco.**

taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations sometimes are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

## Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not named in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

## Survey Procedures

The general procedures followed in making this survey are described in the National Soils Handbook of the Soil Conservation Service. The soil maps made for conservation planning on individual farms prior to the start of the project soil survey were among the references used. The survey of the county published in 1936 also was used.

Before the fieldwork began, many preliminary boundaries of slopes and landforms were plotted stereoscopically on aerial photographs taken in 1982. The soil scientists studied United States Geological Survey topographic maps at a scale of 1:24,000 to relate land and image features. A reconnaissance was then made by vehicle prior to detailed mapping.

At the beginning of the survey, sample areas were selected to represent the major landscapes in the county. These areas were intensively mapped. Extensive field observations of the soils and the composition of map units were made. These preliminary observations were modified as mapping progressed and a final assessment of the composition of the individual map units was made.

Soil scientists traversed the landscape on foot to investigate the soils. In areas of Rossmoyne and Loudon soils, the soil pattern is very complex. The traverses were spaced as close as 200 yards in these areas. In areas where the soil pattern is relatively simple, such as areas of the Faywood-Lowell complex, the traverses were about a quarter of a mile apart. Some transects were made to determine the composition of soil complexes, especially the Faywood-Lowell complex in the southern part of the county. Surface drainage was mapped in the field through the use of aerial photo patterns where applicable.

As the traverses were made, the soil scientists divided the landscape into segments based on the use and management of the soils. For example, a hillside would be separated from a swale and a gently sloping ridgetop from a very steep side slope. In most areas

soil examinations along the traverses were made at points 100 to 800 yards apart, depending on the landscape and soil pattern. Observations of such items as landforms, vegetation, and exposed soil profiles in windthrow pits, roadbanks, and animal burrows were made continuously without regard to spacing. Soil boundaries were determined on the basis of soil examinations, observations, and photo interpretation. The soil material was examined to a depth of about 4 to 6 feet with the aid of a hand auger or a spade. The pedons described as typical were studied in pits that were dug with shovels, mattocks, and digging bars.

Samples for chemical and physical analyses and for analysis of engineering properties were taken from representative sites of several of the soils in the county. The chemical and physical analyses were made by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The results of the analyses are stored in a computerized data file at the laboratory. The analysis of engineering properties was made by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soil and Foundation Section, Columbus, Ohio. A description of the laboratory procedures and results can be obtained on request from the two laboratories. The results of the laboratory analyses also can be obtained from the Ohio Department of Natural Resources, Division of Soil and Water Conservation, Columbus, Ohio, and the Soil Conservation Service, State Office, Columbus, Ohio.

After completion of the soil mapping on aerial photographs, map unit delineations were transferred by hand to another set of the same photographs during map finishing.

# General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Some soil boundaries and soil names in this survey do not fully match those in surveys of adjoining counties that were published at an earlier date. Differences are the result of changes and refinements in series concepts and the application of the latest soil classification system.

## Soil Descriptions

### 1. Clermont-Avonburg Association

*Deep, nearly level and gently sloping, poorly drained and somewhat poorly drained soils formed in loess and glacial till; on the Illinoian till plain*

This association generally is on broad flats, slight rises, and knolls on the Illinoian till plain. It is in areas between widely spaced major drainageways. A few gently sloping areas are along the widely spaced drainageways. Slopes range from 0 to 6 percent.

This association makes up about 38 percent of the county. It is about 55 percent Clermont soils, 25 percent Avonburg soils, and 20 percent soils of minor extent.

The Clermont soils are on broad flats. They are nearly level and poorly drained and have a seasonal high water table at or above the surface. Permeability is very slow.

The Avonburg soils are on nearly level slight rises, low gentle slopes, knolls, and low slopes along shallow drainageways. They are somewhat poorly drained and have a seasonal high water table at a depth of about 12 to 36 inches. Permeability is moderate in the upper part of the profile and very slow in the lower part.

Both of the soils have a surface layer of silt loam. This layer has a moderately low or moderate organic matter content.

Rossmoyne, Atlas, Bonnell, Shoals, and Algiers are some of the minor soils in this association. The moderately well drained Rossmoyne soils and the somewhat poorly drained Atlas soils are in the more sloping areas along drainageways. Atlas soils have more clay in the surface layer than the major soils. The well drained Bonnell soils are on the side slopes bordering stream valleys. Shoals and Algiers soils have more sand in the subsoil than the major soils. They are on flood plains.

Most areas are used as cropland, and some are used as pasture or woodland. This association is well suited or moderately well suited to those uses. It is poorly suited to building site development and septic tank absorption fields.

Ponding, the seasonal wetness, and the restricted permeability are the major limitations affecting farm uses and urban development. Adequate outlets for subsurface drainage systems are not available in most areas. Surface drains are commonly used to remove excess surface water. Planting is often delayed because of the ponding and the wetness. The surface layer of these soils crusts after periods of heavy rainfall. Maintaining tilth is a management concern if the soils are worked when they are too wet. Building sites should be landscaped for good surface drainage away from foundations.

### 2. Rossmoyne-Bonnell Association

*Deep, gently sloping to very steep, moderately well drained and well drained soils formed in loess and glacial till; on the Illinoian till plain*

This association is on knolls, on low ridges, at the head of drainageways, and on side slopes near stream

valleys on the Illinoian till plain. It is in areas where stream valleys are closely spaced. Slopes range from 1 to 60 percent.

This association makes up about 44 percent of the county. It is about 55 percent Rossmoyne soils, 15 percent Bonnell soils, and 30 percent soils of minor extent (fig. 4).

The Rossmoyne soils are on knolls, at the head of drainageways, on low ridges between the larger drainageways, and in sloping areas along the smaller drainageways. They are gently sloping and sloping. They formed in loess and in the underlying glacial till. They are moderately well drained and have a seasonal high water table at a depth of 18 to 36 inches. A compact fragipan is in the subsoil. The organic matter content is moderate to low, depending on the degree of erosion. Permeability is moderate in the upper part of the profile and slow or moderately slow in the fragipan.

The Bonnell soils are on sloping to very steep side slopes along drainageways and on stream valley walls. They formed in glacial till. They are well drained. The organic matter content is moderately low or low, depending on the degree of erosion. Permeability is slow in the subsoil.

Avonburg, Clermont, Atlas, Shoals, Genesee, Williamsburg, Eden, Faywood, Loudon, and Pate soils are of minor extent in this association. The somewhat poorly drained Avonburg soils and the poorly drained Clermont soils are in nearly level areas. The somewhat poorly drained Avonburg and Atlas soils are along shallow drainageways. Shoals, Genesee, and Williamsburg soils have more sand in the subsoil than the major soils. Shoals and Genesee soils are on long, narrow flood plains. Williamsburg soils are on terraces in valleys. The moderately deep Eden and Faywood soils are on unglaciated hillsides, side slopes, and ridgetops. Loudon soils are on ridgetops. The lower part of their subsoil formed in limestone and shale residuum. Pate soils are on the lower parts of hillsides. They formed in colluvial material.

Most areas are used for cultivated crops or pasture, and some are used as woodland. The Rossmoyne soils are better suited to most uses than the Bonnell soils because of the slope. They are well suited, moderately well suited, or poorly suited to crops, pasture, and woodland. The Bonnell soils are poorly suited or generally unsuited to crops and pasture and are well suited or moderately well suited to woodland. This association is moderately well suited, poorly suited, or generally unsuited to building site development and septic tank absorption fields.

The slope and the hazard of erosion are the most important limitations affecting cultivated crops. No-till farming and other kinds of conservation tillage help to prevent excessive erosion. Grassed waterways and crop rotations that include grasses and legumes also help to control erosion. Controlled grazing helps to prevent excessive thinning of the plant cover. A seasonal high water table in gently sloping and sloping areas and the restricted permeability are limitations on sites for buildings and septic tank absorption fields. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. In some areas the slope is a limitation on sites for buildings, septic tank absorption fields, and local roads and streets. Construction sites should be protected against erosion.

### 3. Eden-Pate-Faywood Association

*Moderately deep and deep, strongly sloping to very steep, well drained and moderately well drained soils formed in residuum and colluvium derived from shale and limestone; on uplands*

This association is on hillsides and side slopes along small streams and on ridgetops between the valleys in the unglaciated part of the county. Slopes range from 8 to 70 percent.

This association makes up about 15 percent of the county. It is about 35 percent Eden soils, 20 percent Pate soils, 20 percent Faywood soils, and 25 percent soils of minor extent.

The Eden soils are on long, steep and very steep hillsides. They are moderately deep and well drained. They formed in material weathered from interbedded, soft, calcareous shale and limestone. The organic matter content is low. Permeability is slow. Available water capacity is low. These soils are subject to hillside slippage.

The Pate soils are on toe slopes and the lower third of the hillsides. They are strongly sloping to steep, deep, and moderately well drained and well drained. They formed in colluvium derived from interbedded shale and limestone. The organic matter content is moderately low or moderate. Permeability is very slow. Available water capacity is low or moderate. The moderately steep and steep areas of these soils are subject to hillside slippage.

The Faywood soils are on strongly sloping ridgetops and on moderately steep side slopes along small streams. They are moderately deep and well drained. They formed in residuum of interbedded limestone and shale. The organic matter content is moderately low. Permeability is slow or moderately slow. Available water capacity is low.

Genesee, Shoals, Nolin, Elkinsville, Williamsburg, Cincinnati, Loudon, and Rossmoyne soils are of minor extent in this association. Genesee, Shoals, and Nolin

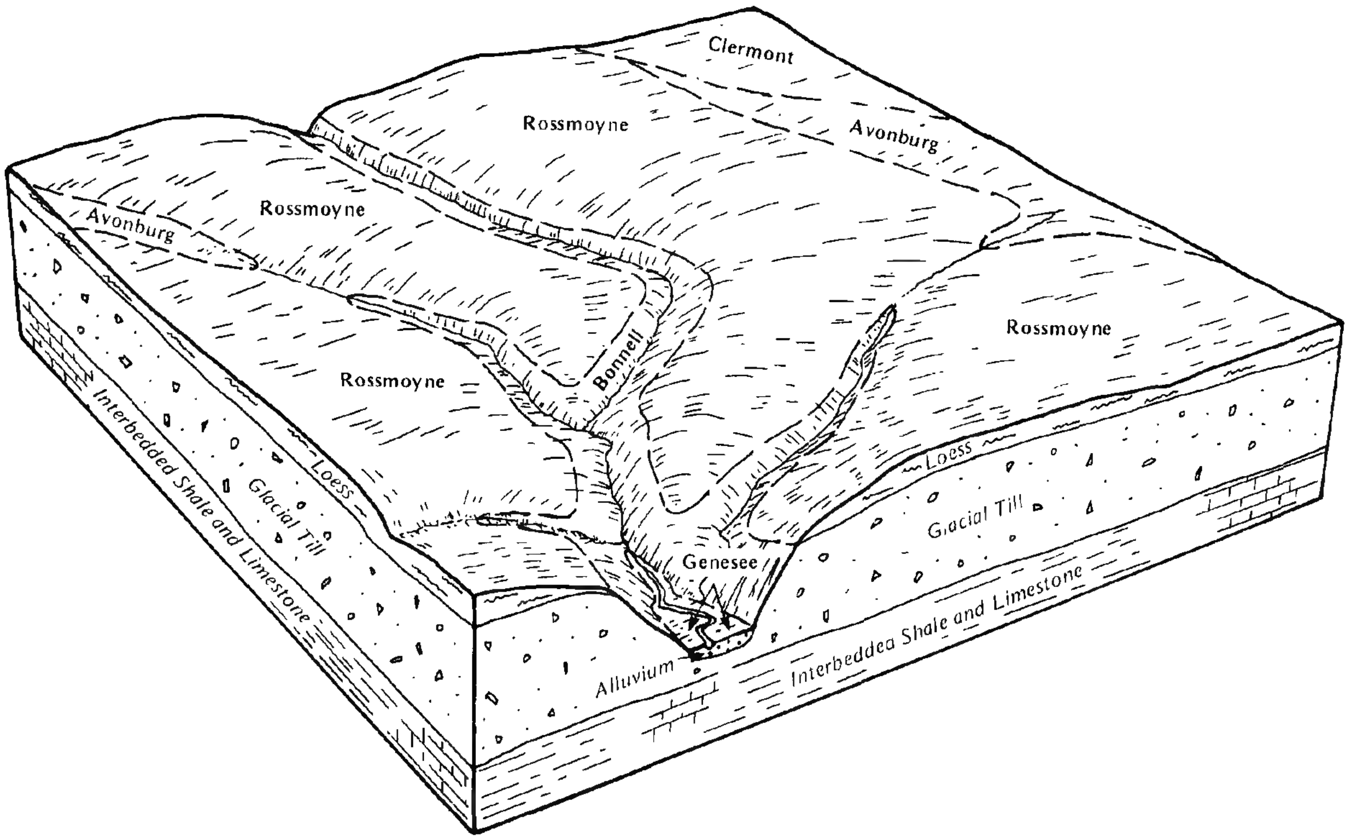



**Figure 4.—Typical pattern of soils and parent material in the Rossmoyne-Bonnell association.**

soils are on flood plains. They have less clay and more sand in the subsoil than the major soils. Elkinsville and Williamsburg soils have more sand in the subsoil than the major soils. They are on terraces. Cincinnati, Loudon, and Rossmoyne soils are on ridgetops. They formed partially in glacial till.

Most areas are used as pasture, hayland, or woodland. The areas on ridgetops and toe slopes are used as cropland. These areas are moderately well suited to tobacco and other crops and are well suited or moderately well suited to pasture. The areas on hillsides are poorly suited or generally unsuited to pasture and are generally unsuited to cropland. This association is moderately well suited or well suited to woodland. The areas on ridgetops are moderately well suited to most kinds of building site development but are poorly suited to septic tank absorption fields because of the restricted permeability. The moderately steep to very steep areas on hillsides are generally unsuited to most kinds of building site development and to septic tank absorption fields.

The slope, the depth to bedrock, and the hazard of erosion are the major limitations affecting most farm and nonfarm uses. No-till farming and other kinds of conservation tillage reduce the hazard of erosion on the ridgetops. Proper stocking rates, pasture rotation, and timely applications of fertilizer help to maintain a good stand of forage plants. In the moderately steep to very steep areas, the main limitations affecting building site development and septic tank absorption fields are the slope, hillside slippage, the restricted permeability, and a high shrink-swell potential in the Pate soils.

### 4. Genesee-Williamsburg Association

*Deep, nearly level and gently sloping, well drained soils formed in alluvium and in loess and glacial outwash; on flood plains and terraces*

This association is on flood plains and terraces along the larger streams. It is in narrow areas that are roughly parallel to the streams. Slopes range from 0 to 6 percent.

This association makes up about 2 percent of the county. It is about 45 percent Genesee soils, 35 percent Williamsburg soils, and 20 percent soils of minor extent.

The Genesee soils are on flood plains and are

occasionally flooded. They are nearly level. Available water capacity is high or very high. Permeability and the organic matter content are moderate.

The Williamsburg soils are on the higher terraces. They are gently sloping. Available water capacity is high. Permeability and the organic matter content are moderate.

Of minor extent in this association are the somewhat poorly drained Shoals soils in sloughs and in high water flood channels.

Most of the acreage is cropland. A few areas are used as hayland or pasture. This association is well suited to cropland, hayland, pasture, and woodland. The Williamsburg soils are well suited to building site development and septic tank absorption fields, but the Genesee soils are generally unsuited.

Flooding is a hazard if the soils on the flood plains are farmed. Usually, however, it does not occur during the growing season. The floodwater often deposits sediments on forage plants and thus reduces the quality of the forage. It scours some areas, destroying planted crops, and carries away recently applied plant nutrients. Erosion is a moderate hazard in the gently sloping areas. It can be controlled by conservation tillage systems, including no-till farming.

### 5. Elkinsville-Nolin Association

*Deep, nearly level to sloping, well drained soils formed in alluvium and glacial outwash; on terraces and flood plains*

This association is on flood plains and terraces along the Ohio River. It is in narrow areas that are roughly parallel to the river. Slopes range from 0 to 12 percent.

This association makes up about 1 percent of the county. It is about 50 percent Elkinsville soils, 30 percent Nolin soils, and 20 percent soils of minor extent.

The Elkinsville soils are on gently sloping and sloping terraces. Permeability is moderate. Available water capacity is high. The surface layer has a moderate organic matter content.

The Nolin soils are on flood plains and are occasionally flooded. They are nearly level. Available water capacity is high. Permeability and the organic matter content are moderate.

Sciotoville and Chili soils are of minor extent in this association. The moderately well drained Sciotoville soils are in the broader, nearly level areas on the terraces. Chili soils have more gravel in the subsoil and substratum than the major soils. They are on very steep side slopes on the terraces.

Most of the acreage is cropland. A few areas are used for pasture, woodland, or urban development. This association is moderately well suited or well suited to crops, pasture, and woodland. The areas on the higher terraces are moderately well suited or well suited to most kinds of building site development and to septic tank absorption fields, but the areas on the lower flood plains are generally unsuited because of flooding.

Flooding is a hazard if the soils on the flood plains are used for urban development or are farmed. Usually, it does not occur during the growing season. The floodwater often deposits sediments on forage plants and thus reduces the quality of the forage. It scours some areas, destroying planted crops, and carries away recently applied plant nutrients. Erosion is a hazard in the gently sloping and sloping areas on the terraces. It can be controlled by conservation tillage systems, including no-till farming.

# Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Rossmoyne silt loam, 1 to 6 percent slopes, is a phase of the Rossmoyne series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A soil complex consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Faywood-Lowell silt loams, 8 to 15 percent slopes, eroded, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

Some soil boundaries and soil names in this survey do not fully match those in the surveys of adjoining counties that were published at an earlier date. Most differences result from a better knowledge of soils or from modifications and refinements in series concepts. Some differences result from variations in the dominance of soils in map units consisting of soils of two or more series and from variations in the range in slope allowed within the map units in the different surveys.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The "Glossary" defines many of the terms used in describing the soils.

## Soil Descriptions

**Ag—Algiers silt loam, frequently flooded.** This deep, nearly level, somewhat poorly drained soil is on flood plains. It is frequently flooded for very brief periods. Slopes are 0 to 2 percent. Most areas are long and narrow and range from 5 to 15 acres in size.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. Below this is about 15 inches of brown and dark grayish brown, mottled, friable loam and silt loam. The next 10 inches is black, friable loam. The subsoil is dark grayish brown and yellowish brown, mottled, friable loam about 19 inches thick. The substratum to a depth of about 63 inches is grayish brown, very friable sandy loam. In some areas the soil is poorly drained. In other areas it does not have a dark buried layer. In a few places it is only occasionally flooded.

Included with this soil in mapping are areas that are ponded for short periods after heavy rainfall. These areas are in depressions in the uplands. Also included are areas of moderately well drained soils and areas of

the well drained Genesee soils on slight rises and the poorly drained Blanchester soils at the head of small drainageways. Included soils make up about 15 percent of most areas.

Permeability is moderate in the Algiers soil. Available water capacity is high. Runoff is slow. A seasonal high water table is at a depth of 1 or 2 feet during extended wet periods. The organic matter content is moderate. The potential for frost action is high.

Most areas are used as cropland. A few are used as pasture.

If drained, this soil is well suited to corn, soybeans, and specialty crops. The hazard of flooding and the seasonal wetness are the major management concerns. Flooding in winter and spring can damage winter wheat and forage crops, but corn, tobacco, and soybeans can usually be grown without flood damage. The wetness delays planting in most years and limits the choice of crops. A subsurface drainage system is commonly used to lower the seasonal high water table. Where tilled, the surface layer crusts after hard rains. Minimizing tillage, incorporating crop residue into the soil, and planting cover crops improve tilth and minimize surface crusting.

This soil is well suited to hay and pasture. Because of the seasonal wetness, it is better suited to grasses than to legumes. The plants grow well through the dry part of the summer. Overgrazing or grazing when the soil is too wet causes compaction and reduces forage yields. Proper stocking rates, pasture rotation, and restricted grazing when the soil is wet help to keep the pasture in good condition. Floodwater commonly deposits sediments on the hayland or pasture, reducing the quality of the forage.

This soil is well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is generally unsuitable as a site for buildings, septic tank absorption fields, and intensive recreational uses because of the hazard of flooding and the seasonal wetness. Coating steel or using concrete minimizes the damage caused by the corrosive effects of this soil. Placing riprap on streambanks or vegetating the streambanks helps to control erosion in some areas.

The land capability classification is IIw. The woodland ordination symbol is 4A. The pasture and hayland suitability group is C-3.

**AtC2—Atlas silty clay loam, 6 to 12 percent slopes, eroded.** This deep, sloping, somewhat poorly drained soil is on side slopes along small drainageways on the Illinoian till plain. Erosion has removed part of the original surface layer, and subsoil material has been tilled into the present surface layer. Areas are irregularly shaped and range from 5 to 20 acres in size.

Typically, the surface layer is brown, firm silty clay loam about 6 inches thick. The upper part of the subsoil is dark yellowish brown, mottled, firm silty clay loam and very firm silty clay. The next part is grayish brown and dark gray, mottled, firm silty clay loam. The lower part to a depth of about 80 inches is strong brown and yellowish brown, firm clay loam. In some areas the subsoil has less clay. In a few areas the surface layer is silt loam. In some areas in minor drainageways, the soil is poorly drained. In places it is gently sloping.

Included with this soil in mapping are small areas of the well drained Jessup and Loudon soils. These soils are shallower to interbedded limestone and shale than the Atlas soil. They are on the more sloping parts of the landscape. Also included are severely eroded spots at the top of slopes and on knolls, the moderately well drained Rossmoyne soils on the upper part of some slopes, and the somewhat poorly drained Avonburg soils in small depressions. In the severely eroded spots, the surface layer is silty clay and tilth is poor. Avonburg soils have more silt in the surface layer and in the upper part of the subsoil than the Atlas soil. Included soils make up about 15 percent of most areas.

Permeability is very slow in the Atlas soil. Available water capacity is moderate. Runoff is rapid. A perched seasonal high water table is at a depth of 1 or 2 feet during extended wet periods. The organic matter content is low. The shrink-swell potential and the potential for frost action are high.

Most areas are used as pasture. Some are used as cropland.

This soil is moderately well suited to corn, small grain, and occasionally grown soybeans. Erosion is a severe hazard in cultivated areas. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer to maintain productivity. The surface layer crusts after hard rains. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, cover crops, and a cropping sequence that includes grasses and legumes minimize crusting and soil loss. A subsurface drainage system is commonly used to lower the seasonal high water table.

This soil is well suited to hay and pasture. Because of the seasonal wetness, it is better suited to grasses than to legumes. Overgrazing or grazing when the soil is wet causes compaction, increases the runoff rate, and reduces forage yields. Pasture rotation and restricted grazing when the soil is wet help to keep the pasture in good condition. If the soil is plowed during seedbed preparation, the hazard of erosion is moderate. It can be reduced by no-till seeding methods.

This soil is moderately well suited to woodland. Large nursery stock, special site preparation, and

reinforcement planting are needed because of seedling mortality. Planting techniques that spread the roots of the seedlings and improve the soil-root contact also reduce the seedling mortality rate. Frequent, light thinning, prevention of damage to surface root systems, and harvest methods that do not isolate the remaining trees or leave them widely spaced minimize the hazard of windthrow.

This soil is poorly suited to building site development and septic tank absorption fields. The seasonal high water table and the high shrink-swell potential are limitations on building sites. The soil is better suited to houses without basements than to houses with basements. Building sites should be landscaped so that surface water drains away from foundations and septic tank absorption fields. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Backfilling excavations along basement walls and foundations with material that has a low shrink-swell potential, designing walls that have pilasters and are reinforced, and supporting the walls on a large spread footing help to prevent the damage caused by shrinking and swelling. Coating steel and concrete minimizes the damage caused by the corrosive effects of this soil.

The suitability of this soil for septic tank absorption fields is limited by the seasonal wetness and the very slow permeability. Installing interceptor drains on the uphill side of the field and perimeter drains around the field helps to lower the seasonal high water table. Enlarging the absorption field helps to overcome the restricted permeability.

The suitability of this soil for local roads and streets is limited by low strength and the high shrink-swell potential. These limitations can be overcome by providing suitable base material and by installing a drainage system.

The land capability classification is IIIe. The woodland ordination symbol is 4C. The pasture and hayland suitability group is C-2.

**AvA—Avonburg silt loam, 0 to 2 percent slopes.** This deep, nearly level, somewhat poorly drained soil is generally on slight rises and broad flats between shallow drainageways on the Illinoian till plain. Areas are irregularly shaped and range from 5 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil extends to a depth of more than 80 inches. The upper part is yellowish brown, light yellowish brown, and light brownish gray, mottled, friable and firm silty clay loam and silt loam. The next part is a fragipan of yellowish brown and dark yellowish brown, mottled, very firm, brittle loam and clay loam. The lower part is dark yellowish brown and yellowish brown, mottled, firm and very firm clay loam and loam. In some areas shale or limestone bedrock is at a depth of 40 to 60 inches. In other areas the soil does not have a fragipan.

Included with this soil in mapping are small areas of the moderately well drained Rossmoyne soils on slight rises. Also included are small areas of the poorly drained Clermont soils in depressions and narrow drainageways. Included soils make up about 15 percent of most areas.

Permeability is moderate in the upper part of the Avonburg soil and very slow in the lower part. Available water capacity is moderate. Runoff is slow. A perched seasonal high water table is at a depth of 1 to 3 feet during extended wet periods. The organic matter content is moderately low. The root zone is restricted by the fragipan at a depth of 29 to 38 inches. The potential for frost action is high.

Most areas are used as cropland. Some are used as pasture or woodland.

If drained, this soil is well suited to corn, soybeans, tobacco, and small grain and to grasses and legumes for hay or pasture. The wetness is the main limitation. The soil dries slowly in spring. As a result, planting is delayed. A subsurface drainage system is commonly used to lower the seasonal high water table. Surface drains are used to remove excess surface water. The soil is subject to surface crusting after hard rains. Returning crop residue to the soil minimizes crusting and improves soil structure.

This soil is well suited to pasture. Because of the wetness, however, it is poorly suited to grazing early in spring. Grazing when the soil is wet causes compaction, decreases the rate of water infiltration, and reduces forage yields. Proper stocking rates, pasture rotation, and restricted grazing when the soil is wet help to keep the pasture in good condition. The species that are tolerant of some wetness, such as alsike clover, should be selected for planting.

This soil is moderately well suited to trees. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Frequent, light thinning and harvesting can increase the vigor of the stand and reduce the hazard of windthrow.

This soil is poorly suited to building site development because of the seasonal high water table and to septic tank absorption fields because of the seasonal high water table and the very slow permeability. It is better suited to houses without basements than to houses with basements. Installing drains at the base of footings, sealing the exterior of basement walls, draining roof water away from the building, and properly landscaping the site help to prevent wetness in basements and

crawl spaces. Installing perimeter drains, enlarging the absorption area, and land shaping that results in good surface drainage help to overcome the very slow permeability and wetness in septic tank absorption fields. Coating concrete and steel minimizes the damage caused by the corrosive effects of this soil.

Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material and by installing a drainage system.

The land capability classification is IIw. The woodland ordination symbol is 4D. The pasture and hayland suitability group is C-2.

**AwB2—Avonburg-Atlas complex, 2 to 6 percent slopes, eroded.** These deep, gently sloping, somewhat poorly drained soils are on knolls and around shallow drainageways on the Illinoian till plain. The Avonburg soil generally is slightly less sloping than the Atlas soil. Erosion has removed part of the original surface layer, and subsoil material has been tilled into the present surface layer. Most areas are irregularly shaped and range from 5 to 30 acres in size. They are about 45 percent Avonburg silt loam and 40 percent Atlas silty clay loam. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the surface layer of the Avonburg soil is brown, friable silt loam about 6 inches thick. The subsoil is about 66 inches thick. The upper part is yellowish brown, mottled, friable and firm silty clay loam and silt loam. The lower part is yellowish brown and grayish brown, mottled, firm and very firm silty clay loam and clay loam. The substratum to a depth of about 80 inches is yellowish brown, very firm loam. In some areas the soil has a thin layer of sandy loam in the lower part.

Typically, the surface layer of the Atlas soil is brown, firm silty clay loam about 6 inches thick. The upper part of the subsoil is dark yellowish brown, mottled, firm silty clay loam and very firm silty clay. The next part is grayish brown and dark gray, mottled, firm silty clay loam. The lower part to a depth of about 80 inches is strong brown and yellowish brown, firm clay loam. In places the subsoil has less clay. In some areas in minor drainageways, the soil is poorly drained.

Included with these soils in mapping are small areas of the well drained Cincinnati and moderately well drained Rossmoyne soils on convex ridgetops and the more sloping parts of the landscape. Included soils make up about 15 percent of most areas.

Permeability is moderate in the upper part of the Avonburg soil and very slow in the lower part. It is very slow in the Atlas soil. Available water capacity is moderate in both soils. Runoff is medium. During extended wet periods, a perched seasonal high water table is at a depth of 1 to 3 feet in the Avonburg soil and 1 or 2 feet in the Atlas soil. The root zone is commonly deep in both soils. The organic matter content is moderately low. The shrink-swell potential is moderate in the Avonburg soil and high in the Atlas soil. The potential for frost action is high in both soils.

Most areas are used for cultivated crops, pasture, or woodland. Some of the acreage is idle land.

These soils are well suited to corn, soybeans, tobacco, and small grain. The seasonal wetness and a moderate hazard of erosion are management concerns. A subsurface drainage system is commonly used to lower the seasonal high water table. Subsurface drains are more effective if they are installed above the very slowly permeable part of the Avonburg soil. They are not so effective in the Atlas soil. Erosion can be controlled by including grasses and legumes in the cropping sequence, returning crop residue to the soils, and establishing grassed waterways. No-till planting or another system of conservation tillage that leaves crop residue on the surface also is effective in controlling erosion. Conservation tillage reduces the number of days needed to work the soils, thus helping to prevent delays in planting caused by wetness. If tilled, the surface layer crusts after hard rains. Returning crop residue to the soils minimizes crusting and improves soil structure.

These soils are well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soils are wet causes surface compaction, decreases the rate of water infiltration, and reduces forage yields. Deferment of grazing during wet periods helps to keep the pasture in good condition. If the soils are plowed during seedbed preparation, the hazard of erosion is moderate. It can be reduced by no-till seeding methods. The species that are tolerant of some wetness, such as alsike clover, should be selected for planting.

These soils are moderately well suited to trees. Selecting seedlings that have been transplanted once and using planting techniques that spread the roots of the seedlings and improve the soil-root contact reduce the seedling mortality rate. Frequent, light thinning and harvesting can increase the vigor of the stand and reduce the hazard of windthrow. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

These soils are poorly suited to building site development and septic tank absorption fields because of the seasonal wetness and the very slow permeability in both soils and the high shrink-swell potential in the Atlas soil. They are better suited to houses without basements than to houses with basements. Installing drains at the base of footings, sealing the exterior of

basement walls, draining roof water away from the building, and properly landscaping the site help to prevent wetness in basements and crawl spaces. Installing perimeter drains, enlarging the absorption area, and land shaping that results in good surface drainage help to overcome the very slow permeability and wetness in septic tank absorption fields. Coating concrete and steel minimizes the damage caused by the corrosive effects of these soils.

Low strength and frost action in the Avonburg soil and low strength and the high shrink-swell potential in the Atlas soil are limitations on sites for local roads and streets. These limitations can be overcome by providing suitable base material and by installing a drainage system.

The land capability classification is IIe. The woodland ordination symbol assigned to the Avonburg soil is 4D, and that assigned to the Atlas soil is 4C. The pasture and hayland suitability group is C-2.

**Bc—Blanchester silt loam.** This deep, nearly level, poorly drained soil generally is in slight depressions on the Illinoian till plain. In some areas it extends along shallow drainageways. It is commonly referred to as "crawfish land." Slopes are 0 to 2 percent. Areas are irregularly shaped or circular. Most are 5 to 100 acres in size.

Typically, the surface layer is dark gray, mottled, friable silt loam about 8 inches thick. The subsoil is about 72 inches thick. The upper part is dark gray, mottled, firm silty clay loam; the next part is gray and grayish brown, mottled, firm silty clay loam; and the lower part is gray and strong brown, mottled, firm clay loam. The substratum to a depth of about 90 inches is yellowish brown, mottled, firm clay loam. In a few places the surface layer is silty clay loam. In some areas it is pale brown or brown.

Included with this soil in mapping are small areas of the somewhat poorly drained Avonburg soils on slight rises. These soils make up about 10 percent of most areas.

Permeability is slow or very slow in the Blanchester soil. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is near or above the surface during extended wet periods. The organic matter content is moderate. The shrink-swell potential and the potential for frost action are high.

Most areas are used for cultivated crops. A few are used as pasture or woodland.

If drained, this soil is well suited to cultivated crops, hay, and pasture. The poor drainage and the slow or very slow permeability are the main limitations. Extended periods of wetness significantly restrict fieldwork and root development. Short-season crops should be selected for planting. A surface drainage system can help to remove excess surface water, but natural drainage outlets are not available in many areas. Draining closed depressions commonly is difficult.

Because of the seasonal wetness, this soil is better suited to grasses than to legumes. Overgrazing or grazing when the soil is wet causes compaction, damages pasture plants, decreases the rate of water infiltration, and reduces forage yields. The species that are tolerant of wetness, such as alsike clover, should be selected for planting.

This soil is moderately well suited to trees. Logging equipment can be used only when the soil is frozen or during the drier part of the year. Frequent, light thinning and harvesting can increase the vigor of the stand and reduce the hazard of windthrow. Selecting large planting stock and using planting techniques that spread the roots of the seedlings and improve the soil-root contact reduce the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is poorly suited to building site development and septic tank absorption fields because of ponding and the slow or very slow permeability. It is better suited to dwellings without basements than to dwellings with basements. Installing drains at the base of footings, sealing the exterior of basement walls, draining roof water away from the building, and land shaping that results in good surface drainage help to prevent wetness in basements and crawl spaces. Good drainage outlets are not available in many areas. Installing perimeter drains, enlarging the absorption area, and proper land grading help to overcome the seasonal wetness and restricted permeability in septic tank absorption fields. Coating concrete and steel minimizes the damage caused by the corrosive effects of this soil.

The suitability of this soil for local roads and streets is limited by frost action, ponding, and low strength. Providing suitable base material and installing a drainage system help to overcome these limitations.

The land capability classification is IIIw. The woodland ordination symbol is 5W. The pasture and hayland suitability group is C-1.

**BoD2—Bonnell silt loam, 15 to 25 percent slopes, eroded.** This deep, moderately steep, well drained soil is on side slopes bordering stream valleys on the Illinoian till plain. Erosion has removed part of the original surface layer, and subsoil material has been tilled into the present surface layer. Most areas are irregularly shaped and range from 5 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam

about 6 inches thick. The subsoil is about 37 inches thick. The upper part is dark yellowish brown, firm clay. The lower part is dark yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, very firm loam. In some areas the upper part of the subsoil is silt loam. In a few places the subsoil is thinner.

Included with this soil in mapping are small areas of Rossmoyne soils along the upper edge of some slopes. Also included, on shoulder slopes, are some areas where the soil is underlain by bedrock within a depth of 40 inches. Included soils make up about 15 percent of most areas.

Permeability is slow in the Bonnell soil. Available water capacity is moderate. Runoff is very rapid. The organic matter content is moderately low. The shrink-swell potential is high in the subsoil.

Most areas are used as pasture. Many are wooded. A few are used as cropland. This soil generally is unsuited to cultivated crops because of the slope and a very severe hazard of erosion.

Because the slope severely limits the use of equipment, this soil is poorly suited to pasture and hay. If well managed, however, it is well suited to grazing in winter and early in spring. The hazard of erosion is severe if the soil is plowed during seedbed preparation or if the pasture is overgrazed. Maintaining the pasture stand helps to control erosion. Seeding a cover crop or a companion crop, mulching, or no-till seeding also reduces the risk of erosion.

Many areas support native hardwoods. This soil is well suited to trees. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Water bars and a plant cover help to control erosion. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Selecting seedlings that have been transplanted once reduces the seedling mortality rate.

This soil is poorly suited to building site development and septic tank absorption fields because of the slope, the slow permeability, and the high shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land. The damage caused by shrinking and swelling can be minimized by designing walls that have pilasters, reinforcing walls and foundations, supporting the walls with a large spread footing, and backfilling around foundations and walls with material that has a low shrink-swell potential. Installing the distribution lines in septic tank absorption fields across the slope helps to prevent excessive seepage of the effluent to the surface. Enlarging the absorption field or installing a double absorption field system helps to overcome the restricted permeability. Runoff and erosion can be controlled by maintaining a plant cover wherever possible on the construction site. Coating steel and concrete minimizes the damage caused by the corrosive effects of this soil.

The land capability classification is VIe. The woodland ordination symbol is 4R. The pasture and hayland suitability group is A-2.

**BoE—Bonnell silt loam, 25 to 40 percent slopes.** This deep, steep, well drained soil is on side slopes bordering stream valleys on the Illinoian till plain. Most areas are irregularly shaped and range from 5 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 35 inches thick. The upper part is dark yellowish brown, firm clay. The lower part is dark yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, very firm loam. In a few places the upper part of the subsoil is silt loam. In some areas the subsoil is thinner.

Included with this soil in mapping are small areas of Rossmoyne soils along the upper edge of some slopes. Also included, on shoulder slopes and the upper half of the slopes, are some areas where the soil is underlain by bedrock within a depth of 40 inches. Included soils make up about 15 percent of most areas.

Permeability is slow in the Bonnell soil. Available water capacity is moderate. Runoff is very rapid. The organic matter content is moderately low. The shrink-swell potential is high in the subsoil.

Most areas are used as pasture or woodland. This soil generally is unsuited to cultivated crops and to forage for hay. The slope and a very severe hazard of erosion severely limit the use of this soil.

This soil is poorly suited to pasture. Maintaining the pasture stand and using no-till seeding methods help to control erosion. The slope limits the use of most kinds of farm machinery.

Many areas support native hardwoods. This soil is well suited to trees. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Selecting seedlings that have been transplanted once reduces the seedling mortality rate.

This soil generally is unsuitable as a site for buildings and septic tank absorption fields. The slope, the high shrink-swell potential, and the slow permeability are the main limitations. Runoff and erosion can be controlled by maintaining a plant cover wherever possible on the construction site. Coating steel and concrete minimizes the damage caused by the corrosive effects of this soil.

The land capability classification is VIe. The

woodland ordination symbol is 4R. The pasture and hayland suitability group is A-3.

**BoF—Bonnell silt loam, 40 to 60 percent slopes.** This deep, very steep, well drained soil is on side slopes along streams on dissected parts of the Illinoian till plain. Most areas are long and narrow and range from 10 to 60 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 4 inches thick. The subsurface layer is brown, friable silt loam about 4 inches thick. The subsoil is firm clay loam about 22 inches thick. The upper part is brown, and the lower part is brown and yellowish brown. The substratum to a depth of about 60 inches is dark yellowish brown, very firm clay loam. In a few places the upper part of the subsoil is silt loam. In some areas the subsoil is thinner.

Included with this soil in mapping are small areas of Rossmoyne soils. These soils are near the upper boundary of some mapped areas. Also included are moderately deep soils on the upper half of some slopes. Included soils make up about 15 percent of most areas.

Permeability is slow in the Bonnell soil. Available water capacity is moderate. Runoff is very rapid. The organic matter content is moderately low. The shrink-swell potential is high in the subsoil.

Most areas are used as woodland (fig. 5). This soil generally is unsuited to cultivated crops, hay, and pasture because of the slope and a very severe hazard of erosion.

Many areas support native hardwoods. This soil is moderately well suited to trees. The slope is a major limitation. Building logging roads and skid trails on the contour, establishing water bars, and logging across the slope help to control erosion and facilitate the use of equipment. Seeding landings, skid trails, and logging roads after harvest can also help to control erosion. Selecting seedlings that have been transplanted once reduces the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil generally is unsuitable as a site for buildings and septic tank absorption fields because of the slope, the high shrink-swell potential, and the slow permeability. Coating steel and concrete minimizes the damage caused by the corrosive effects of this soil.

The land capability classification is VIIe. The woodland ordination symbol is 4R. The pasture and hayland suitability group is H-1.

**BrD3—Bonnell silty clay loam, 15 to 25 percent slopes, severely eroded.** This deep, moderately steep, well drained soil is on side slopes bordering stream valleys on the Illinoian till plain. Erosion has removed most of the original surface layer. As a result, glacial till is nearer the surface. The present surface layer is mostly subsoil material in which tilth is very poor because of a high content of clay. Some areas are dissected by gullies. Most areas are irregularly shaped and range from 5 to 25 acres in size.

Typically, the surface layer is dark yellowish brown, friable and firm silty clay loam about 5 inches thick. The subsoil is firm clay loam about 22 inches thick. The upper part is dark yellowish brown, and the lower part is yellowish brown. The substratum to a depth of about 60 inches is yellowish brown, very firm loam.

Included with this soil in mapping are small areas of Rossmoyne soils. These soils are near the upper border of the mapped areas. Also included, on the upper half of some slopes, are moderately deep soils. Included soils make up about 10 percent of most areas.

Permeability is slow in the Bonnell soil. Available water capacity is moderate. Runoff is very rapid. The organic matter content is low. The shrink-swell potential is high in the subsoil.

Most areas are used as pasture or woodland. This soil generally is unsuited to cultivated crops because of the slope and past erosion.

Because of the slope and the hazard of erosion, this soil is poorly suited to pasture. If well managed, however, it is well suited to grazing in winter and early in spring. It is better suited to grasses than to deep-rooted legumes because of past erosion. Maintaining the pasture stand helps to control erosion. The hazard of erosion is very severe if the soil is plowed during seedbed preparation. Using no-till seeding methods helps to control erosion during reseeding.

Some areas support native hardwoods. This soil is moderately well suited to woodland. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Planting the trees early in spring and selecting seedlings that have been transplanted once reduce the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is poorly suited to building site development and septic tank absorption fields because of the slope, the slow permeability, and the high shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land. The damage caused by shrinking and swelling can be minimized by designing walls that have pilasters, reinforcing walls and foundations, supporting the walls with a large spread footing, and backfilling around foundations and walls with material that has a low shrink-swell potential. Installing the distribution lines in septic tank absorption fields across the slope helps to prevent excessive

**Figure 5.—A wooded area of Bonnell silt loam, 40 to 60 percent slopes. This soil is moderately well suited to trees.**

seepage of the effluent to the surface. Enlarging the absorption field or installing a double absorption field system helps to overcome the restricted permeability. Coating steel and concrete minimizes the damage caused by the corrosive effects of this soil. Runoff and erosion can be controlled by maintaining a plant cover wherever possible on the construction site.

The land capability classification is VIe. The woodland ordination symbol is 3R. The pasture and hayland suitability group is A-2.

**ChF—Chili loam, 35 to 70 percent slopes.** This deep, very steep, well drained soil is on side slopes along small tributaries that enter into the Ohio River on terraces along the river. Most areas are long and narrow and range from 5 to 60 acres in size.

Typically, the surface layer is brown, friable loam about 6 inches thick. The subsoil is about 40 inches thick. The upper part is brown and yellowish brown, friable and very friable loam and gravelly sandy loam. The lower part is dark yellowish brown, very friable gravelly sandy loam and sandy loam. The substratum to a depth of about 65 inches is yellowish brown, loose loamy sand. In a few areas the surface layer is silt loam.

Included with this soil in mapping are areas of soils

that have slopes of 15 to 35 percent. Also included are scattered small areas of Elkinsville soils, which have thick deposits of silty material. Included soils make up less than 10 percent of most areas.

Permeability is moderately rapid in the subsoil of the Chili soil and rapid in the substratum. Available water capacity is low or moderate. Runoff is very rapid. The organic matter content is moderately low.

Most areas are used as woodland. This soil generally is unsuited to cultivated crops, hay, and pasture because of the slope and a very severe hazard of erosion.

This soil is moderately well suited to trees. The slope is a major limitation. Building logging roads and skid trails on the contour and logging across the slope facilitate the use of equipment and help to control erosion. Water bars and a plant cover also help to control erosion. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil generally is unsuitable as a site for buildings and septic tank absorption fields because of the slope. The soil has a highly corrosive effect on concrete, but other material, such as steel, can be substituted.

The land capability classification is VIIe. The woodland ordination symbol is 4R. The pasture and hayland suitability group is H-1.

**CnC2—Cincinnati silt loam, 6 to 12 percent slopes, eroded.** This deep, sloping, well drained soil is on ridgetops, at the head of drainageways, and on side slopes along drainageways on the Illinoian till plain. Erosion has removed part of the original surface layer, and subsoil material has been tilled into the present surface layer. Areas are irregularly shaped and range from 5 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 72 inches thick. It is yellowish brown and dark yellowish brown. It is mottled below a depth of about 36 inches. The upper part is friable silt loam and firm silty clay loam. The next part is a fragipan of very firm loam. The lower part is firm clay loam. The substratum to a depth of about 80 inches is yellowish brown, mottled, firm loam. In some areas the soil does not have a fragipan. In other areas it is gently sloping. In places it is moderately well drained.

Included with this soil in mapping are scattered small areas of the well drained Jessup and Loudon soils. These soils are shallower to interbedded limestone and shale bedrock than the Cincinnati soil. Also included are areas of the somewhat poorly drained Avonburg soils on toe slopes and along drainageways. Included soils make up about 10 percent of most areas.

Permeability is moderate in the upper part of the Cincinnati soil and slow or moderately slow in the fragipan. Root growth is restricted mainly to the zone above the fragipan. Available water capacity is low in this zone. Runoff is rapid. A perched seasonal high water table is at a depth of 2.5 to 4.0 feet during extended wet periods. The organic matter content is moderately low or moderate. The potential for frost action is high.

Most areas are used as pasture. Some are used as cropland. This soil is moderately well suited to corn, soybeans, tobacco, wheat, oats, and hay. Erosion is a severe hazard in cultivated areas. If tilled, the surface layer crusts after hard rains. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, cover crops, and a cropping sequence that includes grasses and legumes minimize crusting and erosion.

This soil is well suited to hay and pasture. Overgrazing or grazing when the soil is wet causes compaction, increases the runoff rate, and reduces forage yields. Deferment of grazing during wet periods helps to keep the pasture in good condition. Erosion is a severe hazard if the soil is plowed during seedbed preparation. Seeding a companion crop or no-till seeding reduces the risk of erosion.

This soil is moderately well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is only moderately well suited to building site development and poorly suited to septic tank absorption fields because of the slope, the seasonal wetness, and the slow or moderately slow permeability. Buildings should be designed so that they conform to the natural slope of the land. Because of the seasonal wetness, the soil is better suited to houses without basements than to houses with basements. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Runoff and erosion can be controlled by maintaining a plant cover wherever possible on the construction site. Installing the distribution lines in septic tank absorption fields across the slope helps to prevent excessive seepage of the effluent to the surface. The restricted permeability can be overcome by installing the distribution lines as shallow as possible and by alternating the distribution of effluent into two absorption fields. Installing perimeter drains around the absorption field reduces the seasonal wetness. Coating steel and concrete minimizes the damage caused by the corrosive effects of this soil.

Low strength and frost action are limitations on sites for local roads. These limitations can be overcome by providing suitable base material and by installing a drainage system.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The pasture and hayland suitability group is F-3.

**Ct—Clermont silt loam.** This deep, nearly level, poorly drained soil is on broad flats on the Illinoian till plain. Slopes are 0 to 2 percent. Areas are irregularly shaped and range from 10 to several thousand acres in size.

Typically, the surface layer is grayish brown, mottled, friable silt loam about 7 inches thick. The subsurface layer is light brownish gray, mottled, friable silt loam about 8 inches thick. The subsoil extends to a depth of 80 inches or more. It is light brownish gray, mottled, friable and firm silt loam and silty clay loam in the upper part; dark yellowish brown, mottled, firm clay loam and clay in the next part; and yellowish brown, mottled, firm clay loam in the lower part. In some areas the soil is slightly wetter and has a dark gray surface layer.

Included with this soil in mapping are small areas of the somewhat poorly drained Avonburg soils on slight rises. These soils make up about 10 percent of most areas.

Permeability is very slow in the Clermont soil. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is near or above the surface during extended wet periods. The organic matter content is moderately low or moderate. The potential for frost action is high.

Most areas are used for cultivated crops. Some are used as pasture. If drained, this soil is moderately well suited to cultivated crops, hay, and pasture. The wetness and the very slow permeability are the main limitations. Extended periods of wetness greatly delay planting and reduce the number of days when the soil is suitable for fieldwork. Short-season crops should be selected for planting. A surface drainage system can help to remove excess surface water. Because of the very slow permeability, subsurface drains are not very effective. Adequate drainage outlets for these drains are not available in many areas.

This soil is moderately well suited to pasture and hay. Overgrazing or grazing when the soil is wet causes compaction, decreases the rate of water infiltration, and damages pasture. Because of the seasonal wetness, the soil is better suited to grasses than to legumes.

This soil is moderately well suited to woodland. The seasonal wetness limits the use of equipment. Choosing equipment that operates satisfactorily under wet conditions helps to overcome the equipment limitation. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Selecting seedlings that have been transplanted once reduces the seedling mortality rate. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced reduce the hazard of windthrow.

This soil is poorly suited to building site development and septic tank absorption fields because of the ponding and the very slow permeability. Installing drains at the base of footings, coating the exterior of walls, draining roof water away from the buildings, and landscaping the site so that water drains away from foundations help to keep basements and crawl spaces dry. The soil is better suited to houses without basements than to houses with basements. Natural drainage outlets are not available in many areas. A pump drainage system is needed in these areas. Installing perimeter drains around septic tank absorption fields lowers the seasonal high water table. Enlarging the absorption field helps to overcome the restricted permeability. Properly landscaping the site helps to drain surface water away from the absorption field. Coating steel and concrete minimizes the damage caused by the corrosive effects of this soil.

The ponding, frost action, and low strength are severe limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material and by installing a drainage system.

The land capability classification is IIIw. The woodland ordination symbol is 5W. The pasture and hayland suitability group is F-7.

**EaE—Eden flaggy silt loam, 25 to 40 percent slopes.** This moderately deep, steep, well drained soil is on hillsides in the uplands. Most areas are dissected by shallow drainageways, and many have hillside slips. Most areas are long and narrow or irregularly shaped and range from 5 to 200 acres in size.

Typically, the surface layer is dark brown, very friable flaggy silt loam about 5 inches thick. The subsoil is about 29 inches thick. The upper part is brown, friable flaggy silty clay loam; the next part is yellowish brown, firm flaggy clay; and the lower part is light olive brown, firm flaggy silty clay. Interbedded soft shale and limestone bedrock is at a depth of about 34 inches. In some small areas the surface layer is very dark brown flaggy silty clay loam. In a few places the soil is deep over bedrock.

Included with this soil in mapping are narrow strips of Faywood soils on the upper part of some slopes, areas of gently sloping soils on narrow benches on hillsides, and small areas of bedrock outcrops. Faywood soils have a lower content of coarse fragments in the subsoil than the Eden soil. Also included, in severely overgrazed pastures, are small areas of severely eroded soils. These soils typically have a surface layer of olive brown, calcareous clay or silty clay. They are

commonly shallow over bedrock. Inclusions make up about 15 percent of most areas.

Permeability is slow in the Eden soil. Available water capacity is low. Runoff is very rapid. The root zone is restricted mainly to the 20- to 40-inch zone above the shale and limestone bedrock. The organic matter content is low.

Most areas are used as pasture or woodland. This soil generally is unsuited to cropland and hayland because of the slope. It is poorly suited to pasture. In overgrazed areas the hazard of erosion is severe. Controlling erosion, maintaining a good stand of forage species, and conserving moisture are the major management concerns. Growing companion crops or no-till seeding reduces the hazard of erosion during reseeding. The soil is well suited to grazing in winter and early in spring.

This soil is moderately well suited to trees and to habitat for woodland wildlife. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Selecting seedlings that have been transplanted once reduces the seedling mortality rate. Frequent, light thinning and harvesting can increase the vigor of the stand and reduce the hazard of windthrow. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil generally is unsuitable as a site for buildings and septic tank absorption fields because of the slope, the depth to bedrock, and hillside slippage.

The land capability classification is VIIe. The woodland ordination symbol is 4R. The pasture and hayland suitability group is F-2.

**EaF—Eden flaggy silt loam, 40 to 70 percent slopes.** This moderately deep, very steep, well drained soil is on hillsides in the uplands. It generally is on the upper third of the slopes. Most areas are dissected by shallow drainageways and have hillside slips. Areas are long and narrow or irregularly shaped and range from 5 to 500 acres in size.

Typically, the surface layer is dark brown, very friable flaggy silt loam about 5 inches thick. The subsoil is about 29 inches thick. The upper part is brown, friable flaggy silty clay loam; the next part is yellowish brown, firm flaggy clay; and the lower part is light olive brown, firm flaggy silty clay. Interbedded limestone and calcareous shale bedrock is at a depth of about 34 inches.

Included with this soil in mapping are narrow strips of Faywood soils on the upper part of some slopes. These soils have a lower content of coarse fragments in the subsoil than the Eden soil. Also included are gently sloping soils on narrow benches on hillsides and many small areas of bedrock outcrops. Inclusions make up about 10 percent of most areas.

Permeability is slow in the Eden soil. Available water capacity is low. Runoff is very rapid. The root zone is restricted mainly to the 20- to 40-inch zone above the shale and limestone bedrock. The organic matter content is low.

Most areas are used as woodland. This soil is moderately well suited to trees. It generally is unsuited to cropland and pasture. Building logging roads and skid trails on the contour, establishing water bars, and logging across the slope facilitate the use of equipment and help to control erosion. Maintaining a good plant cover also helps to control erosion. Selecting seedlings that have been transplanted once reduces the seedling mortality rate. Planting techniques that spread the roots of the seedlings and improve the soil-root contact reduce the seedling mortality rate. Frequent, light thinning and harvesting can increase the vigor of the stand and reduce the hazard of windthrow. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil generally is unsuitable as a site for buildings and septic tank absorption fields because of the slope, the depth to bedrock, and hillside slippage.

The land capability classification is VIIe. The woodland ordination symbol is 4R. The pasture and hayland suitability group is H-1.

**EkB—Elkinsville silt loam, 2 to 6 percent slopes.** This deep, gently sloping, well drained soil is on terraces. Most areas are oblong and rather narrow and range from 5 to 60 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 54 inches thick. The upper part is yellowish brown and dark yellowish brown, friable and firm silt loam and silty clay loam. The lower part is yellowish brown and dark brown, friable sandy loam. The substratum to a depth of about 80 inches is dark yellowish brown, very friable fine sandy loam that has a few very thin lenses of fine gravel.

Included with this soil in mapping are a few small areas of Pate soils on slope breaks to the uplands and a few small areas of Nolin soils on flood plains. Included soils make up about 15 percent of most areas.

Permeability is moderate in the Elkinsville soil. Available water capacity is high. Runoff is medium. The root zone is deep. The organic matter content is moderate. The shrink-swell potential also is moderate, and the potential for frost action is high.

Most areas are used as cropland. A few are used as woodland or pasture. This soil is well suited to corn,

soybeans, tobacco, wheat, oats, and hay. Maintaining the organic matter content and controlling erosion are the main management concerns. In tilled areas the surface layer crusts after hard rains. Applying a system of conservation tillage, including grasses and legumes in the cropping sequence, planting cover crops, and returning crop residue to the soil can help to control erosion, improve tilth, minimize crusting, and increase the rate of water infiltration and the organic matter content.

This soil is well suited to pasture. Because of good natural drainage, it is well suited to grazing in winter and early in spring. Alfalfa is suitable in areas where the soil is limed. Adding grasses to alfalfa stands protects the alfalfa from frost action.

This soil is well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is well suited to building site development, septic tank absorption fields, and intensive recreational uses. Properly designing foundations and footings and backfilling along the foundations with material that has a low shrink-swell potential help to prevent the damage caused by shrinking and swelling. Coating concrete and steel minimizes the damage caused by the corrosive effects of this soil. Building sites should be landscaped so that surface water drains away from foundations and septic tank absorption fields.

Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material and by installing a drainage system.

The land capability classification is IIe. The woodland ordination symbol is 5A. The pasture and hayland suitability group is A-6.

**EkC2—Elkinsville silt loam, 6 to 12 percent slopes, eroded.** This deep, strongly sloping, well drained soil is on terrace slope breaks. Erosion has removed part of the original surface layer, and subsoil material has been tilled into the present surface layer. Most areas are long and narrow and range from 3 to 25 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 54 inches thick. The upper part is yellowish brown and dark yellowish brown, firm silty clay loam. The lower part is yellowish brown and dark brown, friable sandy loam. The substratum to a depth of about 80 inches is dark yellowish brown, very friable fine sandy loam.

Included with this soil in mapping are a few small areas of Pate soils on slope breaks to upland hillsides and a few small areas of Nolin soils on flood plains. Included soils make up about 20 percent of most areas.

Permeability is moderate in the Elkinsville soil. Available water capacity is high. Runoff is medium. The root zone is deep. The organic matter content is moderate. The shrink-swell potential also is moderate, and the potential for frost action is high.

Most areas are used as pasture. Some are used as cropland or woodland.

This soil is moderately well suited to corn, soybeans, tobacco, wheat, and oats. Erosion is a severe hazard in cultivated areas. If tilled, the surface layer crusts after hard rains. Applying a system of conservation tillage, such as no-till farming, establishing grassed waterways, growing cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to control erosion, minimize crusting, and improve tilth.

This soil is well suited to pasture and hay. If properly managed, it is well suited to grazing in winter and early in spring. Alfalfa is suitable in areas where the soil is limed. Adding grasses to the alfalfa stand minimizes the damage caused by frost action. No-till seeding helps to control erosion.

This soil is well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is moderately well suited to building site development and septic tank absorption fields. The slope and the moderate shrink-swell potential are the main limitations. Land shaping is needed in some areas, but designing buildings so that they conform to the natural slope of the land minimizes the need for cutting and filling. Building sites should be landscaped so that surface water drains away from foundations and septic tank absorption fields. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the damage caused by shrinking and swelling. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of the effluent to the surface. Maintaining as much vegetation on the site as possible during construction helps to control erosion. Coating concrete and steel minimizes the damage caused by the corrosive effects of this soil.

Low strength and frost action are limitations on sites for local roads and streets. Providing suitable base material minimizes the damage caused by these limitations.

The land capability classification is IIIe. The woodland ordination symbol is 5A. The pasture and hayland suitability group is A-6.

**FdD2—Faywood silt loam, 15 to 25 percent slopes, eroded.** This moderately deep, moderately steep, well drained soil is on side slopes along small streams in the uplands. Erosion has removed part of the original

surface layer, and subsoil material has been tilled into the present surface layer. Most areas are long and narrow or irregularly shaped and range from 10 to 300 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 9 inches thick. The subsoil is firm silty clay about 19 inches thick. The upper part is yellowish brown, and the lower part is yellowish brown and olive brown and is mottled. Bedrock is at a depth of about 28 inches. It is limestone interbedded with some layers of shale. In some areas the surface is silty clay loam. In other areas the soil is more than 40 inches deep over bedrock.

Included with this soil in mapping are areas of soils that have slopes of 8 to 15 percent. These soils are on ridgetops. Also included are some areas on downstream side slopes that have slopes of 25 to 35 percent and scattered areas of soils that are shallow over interbedded shale and limestone bedrock. Included soils make up about 15 percent of most areas.

Permeability is slow or moderately slow in the subsoil of the Faywood soil. Available water capacity is low. Runoff is very rapid. The organic matter content is moderately low.

Most areas are used as pasture or hayland (fig. 6). This soil is poorly suited to hay and pasture. It generally is unsuited to corn and soybeans because of the slope and the hazard of erosion. The slope limits the use of some farm machinery. In overgrazed areas the hazard of erosion is severe. Controlling erosion, maintaining a good stand of forage species, and conserving moisture are the major concerns in managing pasture. Compaction, poor tilth, and excessive runoff result from grazing when the soil is too wet. Companion crops or no-till seeding methods reduce the hazard of erosion during reseeding. Proper stocking rates, pasture rotation, and timely applications of fertilizer help to maintain the stand of forage species and conserve moisture.

This soil is moderately well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Building logging roads and skid trails on the contour and establishing water bars facilitate the use of equipment and help to control erosion. The hazard of windthrow can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

This soil generally is unsuitable as a site for buildings and septic tank absorption fields because of the slope, the depth to bedrock, and the slow permeability. Areas that have been cut and filled are subject to slippage. The interbedded shale and limestone bedrock can be ripped with heavy equipment and rarely requires blasting. Coating steel and concrete minimizes the damage caused by the corrosive effects of this soil.

The slope and low strength are limitations on sites for local roads and streets. The damage caused by low strength can be minimized by providing suitable base material. The roads and streets should be built on the contour.

The land capability classification is VIe. The woodland ordination symbol is 4R. The pasture and hayland suitability group is F-1.

**FeC2—Faywood-Lowell silt loams, 8 to 15 percent slopes, eroded.** These strongly sloping, well drained, moderately deep and deep soils are on the tops of ridges in the uplands. The Faywood soil generally is on shoulder slopes and in the more sloping areas. The Lowell soil generally is on the crest of the ridgetops and in the less sloping areas. Erosion has removed part of the original surface layer, and subsoil material has been tilled into the present surface layer. Most areas are irregularly shaped and range from 15 to 150 acres in size. They are about 50 percent Faywood silt loam and 35 percent Lowell silt loam. The two soils occur as areas so intricately mixed or so small in size that separating them in mapping is not practical.

Typically, the surface layer of the Faywood soil is brown, friable silt loam about 9 inches thick. The subsoil is firm silty clay about 19 inches thick. The upper part is yellowish brown, and the lower part is yellowish brown and olive brown and is mottled. Bedrock is at a depth of about 28 inches. It is limestone interbedded with some shale. In some areas the surface layer is silty clay loam.

Typically, the surface layer of the Lowell soil is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown, firm silty clay loam and silty clay; the next part is dark yellowish brown, firm silty clay; and the lower part is light olive brown, mottled, firm clay. Bedrock is at a depth of about 44 inches. It is interbedded hard limestone and thin beds of calcareous shale.

Included with these soils in mapping are gently sloping soils near the tops of the ridges and moderately steep soils on side slopes. Also included, in slight depressions, are areas of soils that have a seasonal high water table in the upper part of the subsoil. Included soils make up about 15 percent of most areas.

Permeability is slow or moderately slow in the Faywood soil and moderately slow in the Lowell soil. Available water capacity is low in the Faywood soil and moderate in the Lowell soil. Runoff is rapid on both soils. The organic matter content is moderately low. The shrink-swell potential is moderate.

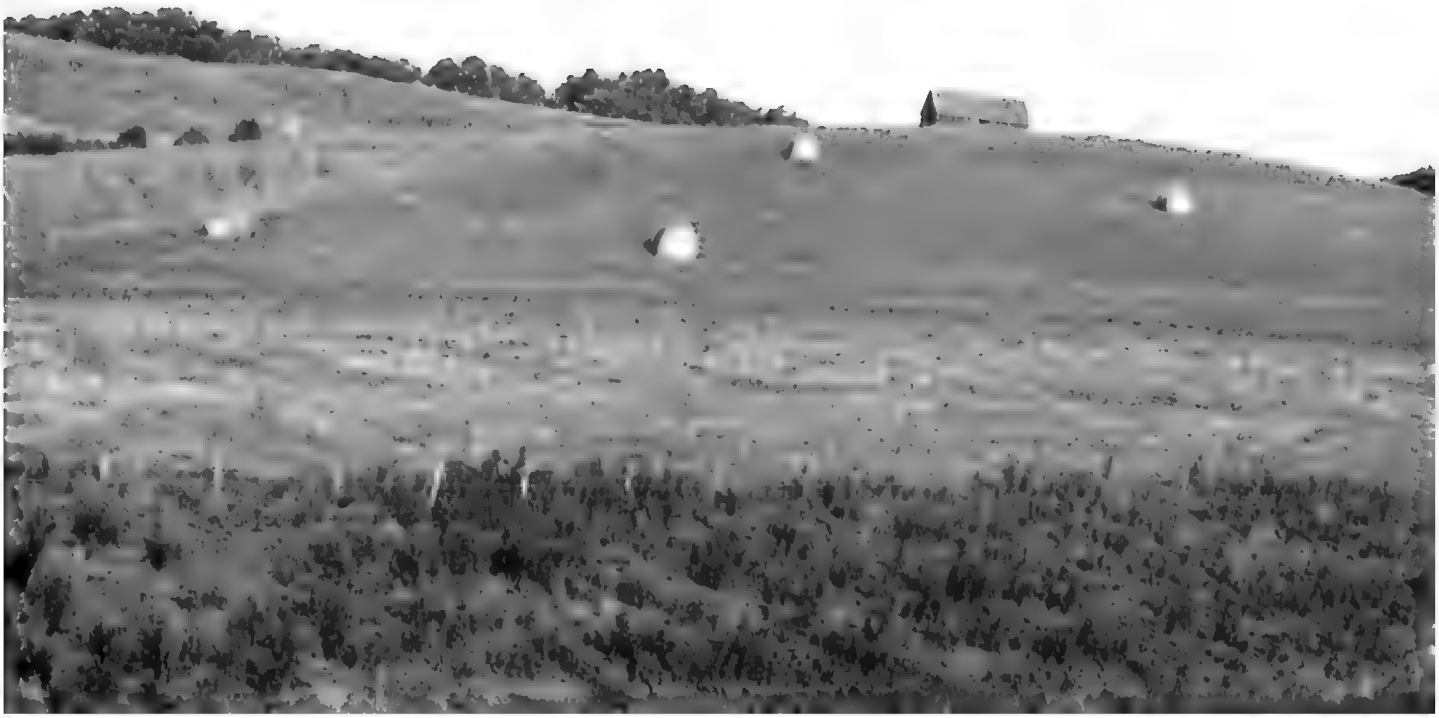


**Figure 6.—Hay in an area of Faywood silt loam, 15 to 25 percent slopes, eroded.**

Most areas are used as cropland. These soils are moderately well suited to corn, small grain, grasses and legumes for hay, and occasionally grown soybeans and tobacco. The hazard of erosion is severe. A cropping sequence that includes grasses and legumes, cover crops, and conservation tillage systems that leave crop residue on the surface can help to control erosion.

These soils are well suited to pasture. Overgrazing or grazing when the soils are wet causes compaction and poor tilth and increases the hazards of runoff and erosion. If the soils are plowed during seedbed preparation, the hazard of erosion is severe. Seeding a companion crop, mulching, or no-till seeding reduces this hazard.

These soils are moderately well suited to woodland. The hazard of windthrow on the Faywood soil can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

These soils are only moderately well suited to building site development because of the slope, the moderate shrink-swell potential, and the depth to bedrock. The Lowell soil is better suited than the Faywood soil. The buildings should be designed so that they conform to the natural slope of the land. In most areas the bedrock interferes with excavation for basements and utility lines. Excavating the bedrock is very difficult, but the upper part can be ripped in some areas. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the damage caused by shrinking and swelling. Coating steel and concrete minimizes the damage caused by the corrosive effects of these soils.

These soils are poorly suited to septic tank absorption fields because of the slope, the restricted permeability, and the depth to bedrock. Enlarging the absorption fields, installing perimeter drains, and

alternating the distribution of effluent into two absorption fields help to overcome the restricted permeability. The Faywood soil is not deep enough to filter the effluent adequately. The effluent can seep into fractures in the bedrock and contaminate underground water supplies. Installing the absorption field in suitable fill material elevates the field a sufficient distance above the bedrock and increases the absorption rate.

Low strength is a limitation on sites for local roads and streets. The damage caused by this limitation can be minimized by providing suitable base material.

The land capability classification is IIIe. The woodland ordination symbol assigned to the Faywood soil is 4D, and that assigned to the Lowell soil is 5A. The pasture and hayland suitability group assigned to the Faywood soil is F-1, and that assigned to the Lowell soil is A-1.

**Ge—Genesee silt loam, occasionally flooded.** This deep, nearly level, well drained soil is on flood plains. It is occasionally flooded for brief periods. Slopes are 0 to 2 percent. Most areas are long and rather narrow and range from 2 to 80 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The upper part of the substratum is brown, friable silt loam and loam. The lower part to a depth of about 60 inches is brown, friable, stratified loam and fine sandy loam. In some areas the surface layer is loam or is darker. In a few areas the soil is slightly wetter and has mottles in the lower part of the subsoil. In places the substratum has a dark layer below a depth of 2 or 3 feet. In a few places the soil has more sand throughout.

Included with this soil in mapping are narrow strips of the somewhat poorly drained Shoals soils in sloughs or high water flood channels. These soils make up about 10 percent of most areas.

Permeability is moderate in the Genesee soil. Available water capacity is very high or high. Runoff is slow. The organic matter content is moderate.

Most areas are used as cropland. A few are used as pasture or woodland.

This soil is well suited to corn, tobacco, soybeans, wheat, hay, and specialty crops. Flooding in winter and spring can damage winter wheat, but corn, tobacco, and soybeans can usually be grown without flood damage. The soil is highly productive. Regular additions of fertilizer help to maintain the level of productivity. Floodwater often deposits sediments on hay plants, reducing the quality of the forage, and scours some areas, destroying planted crops and carrying away recently applied plant nutrients. In some areas riprap or a plant cover is needed to reduce the hazard of streambank erosion.

This soil is well suited to grasses and legumes for pasture. The flooding is a hazard.

This soil is well suited to trees and to habitat for openland and woodland wildlife. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil generally is unsuitable as a site for buildings and septic tank absorption fields because of the flooding. It is suited to extensive recreational uses, such as golf fairways and hiking trails. The soil is a good source of topsoil. Special measures are needed in some areas to keep streams from forming new channels.

The land capability classification is IIw. The woodland ordination symbol is 5A. The pasture and hayland suitability group is A-5.

**JeC2—Jessup silt loam, 8 to 15 percent slopes, eroded.** This deep, strongly sloping, well drained soil is at the head of drainageways and on side slopes along drainageways near the margin of the Illinoian till plain. Erosion has removed part of the original surface layer, and subsoil material has been tilled into the present surface layer. Most areas are irregularly shaped or fan shaped and range from 5 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 49 inches thick. The upper part is yellowish brown, firm silty clay loam; the next part is brown and yellowish brown, firm silty clay loam; and the lower part is yellowish brown and light olive brown, firm clay. The substratum to a depth of about 80 inches is light olive brown and grayish brown, firm silty clay. In some areas the soil is moderately deep.

Included with this soil in mapping are scattered small areas of the moderately well drained Rossmoyne soils. These soils have thicker deposits of till than the Jessup soil. Also included are a few scattered areas of gently sloping soils and areas of moderately well drained soils. Included soils make up about 15 percent of most areas.

Permeability is slow in the Jessup soil. Available water capacity is moderate or high. Runoff is rapid. The organic matter content is moderately low. The shrink-swell potential is moderate.

Most areas are used as pasture. Some are used for cultivated crops. A few are used as woodland.

This soil is well suited to corn, tobacco, soybeans, and small grain and to grasses and legumes for hay and pasture. The hazard of erosion is severe, especially in areas that have been plowed in the fall. No-till farming or another system of conservation tillage and a cropping sequence that includes grasses and legumes help to control erosion. Grassed waterways help to prevent gully erosion where runoff concentrates.

Overgrazing or grazing when the soil is wet causes surface compaction, increases the runoff rate, and reduces yields. Proper stocking rates, pasture rotation, and mowing for weed control help to keep the pasture in good condition.

This soil is moderately well suited to woodland. Selecting seedlings that have been transplanted once and planting early in spring reduce the seedling mortality rate. Frequent, light thinning and harvesting can increase the vigor of the stand and reduce the hazard of windthrow. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is only moderately well suited to building site development and poorly suited to septic tank absorption fields because of the slow permeability, the moderate shrink-swell potential, and the slope. Buildings should be designed so that they conform to the natural slope of the land. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the damage caused by shrinking and swelling. Excavation is difficult in some included areas because of the depth to bedrock. Widening the bottom of the trench in septic tank absorption fields helps to overcome the slow permeability. Alternating the distribution of effluent into two absorption fields also helps to overcome this limitation. Installing the distribution lines across the slope helps to prevent excessive seepage of the effluent to the surface. Coating steel and concrete minimizes the damage caused by the corrosive effects of this soil.

Low strength is a limitation on sites for local roads and streets. Providing suitable base material helps to overcome this limitation.

The land capability classification is IIIe. The woodland ordination symbol is 3C. The pasture and hayland suitability group is A-1.

**JeD2—Jessup silt loam, 15 to 25 percent slopes, eroded.** This deep, moderately steep, well drained soil is on side slopes bordering stream valleys near the margin of the Illinoian till plain. Erosion has removed part of the original surface layer, and subsoil material has been tilled into the present surface layer. Most areas are elongated or irregularly shaped and range from 5 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 49 inches thick. The upper part is yellowish brown, firm silty clay loam; the next part is brown and yellowish brown, firm silty clay loam; and the lower part is yellowish brown and light olive brown, firm clay. The substratum to a depth of about 80 inches is light olive brown and grayish brown, firm silty clay. In some areas the soil is moderately deep. In a few places the subsoil formed entirely in glacial till.

Included with this soil in mapping are small areas of Rossmoyne soils. These soils are along the upper boundary of the mapped areas. They have a fragipan. Also included are small areas of moderately well drained soils in minor drainageways. Included soils make up about 15 percent of most areas.

Permeability is slow in the Jessup soil. Available water capacity is moderate or high. Runoff is very rapid. The organic matter content is moderately low.

Most areas are used as pasture. A few are used as cropland. Some are used as woodland.

This soil is poorly suited to cultivated crops and moderately well suited to pasture. The hazard of erosion is severe in cultivated areas. The slope severely limits the use of this soil as cropland. Contour farming, no-till farming or another system of conservation tillage, grassed waterways, a cropping sequence that includes grasses and legumes in rotation, and cover crops reduce the hazard of erosion and improve tilth. Grazing when the soil is wet causes compaction and excessive runoff. Restricted grazing when the soil is wet helps to keep the pasture in good condition. The no-till method of pasture renovation helps to control erosion during reseeding. Proper stocking rates, pasture rotation, and mowing to control weeds help to keep the pasture in good condition.

This soil is well suited to woodland. Selecting seedlings that have been transplanted once and planting early in spring reduce the seedling mortality rate. Building logging roads and skid trails on the contour and establishing water bars facilitate the use of equipment and help to control erosion. Maintaining a plant cover also helps to control erosion. Frequent, light thinning and harvesting can increase the vigor of the stand and reduce the hazard of windthrow. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is poorly suited to building site development and septic tank absorption fields and is only moderately well suited to some recreational uses because of the slope and the slow permeability. The less sloping areas are better building sites. Land shaping is needed on these sites. If retaining walls are used, buildings can be designed so that they conform to the natural slope of the land. Coating steel and concrete minimizes the damage caused by the corrosive effects of this soil. Widening the bottom of the trench in septic tank absorption fields and increasing the size of the absorption fields can help to overcome the slow permeability. Installing the distribution lines across the slope helps to prevent excessive seepage of the

effluent to the surface. Maintaining a plant cover on the construction site helps to control erosion.

The slope and low strength are limitations on sites for local roads and streets. The roads and streets should be built across the slope. The damage caused by low strength can be minimized by providing suitable base material.

The land capability classification is IVe. The woodland ordination symbol is 3R. The pasture and hayland suitability group is A-2.

**Ju—Jules silt loam, frequently flooded.** This deep, nearly level, well drained soil is on flood plains. It generally is on the lowest levels above the stream channels. Flooding commonly occurs for brief periods in spring, but it can occur at any time of the year. Slopes are 0 to 2 percent. Most areas are elongated, narrow strips that roughly parallel the stream channels. They range from 5 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The substratum to a depth of about 60 inches also is brown, friable silt loam. In some areas the soil does not contain carbonates.

Included with this soil in mapping are small areas of soils that are sandy loam or loamy sand throughout. These soils are near the stream channels. They make up about 5 percent of most areas.

Permeability is moderate in the Jules soil. Available water capacity is very high. Runoff is slow. The root zone is deep. The organic matter content is moderately low. The potential for frost action is high.

Most areas are used as cropland. A few are used as woodland.

This soil is well suited to corn, soybeans, wheat, and hay. Corn and soybeans can usually be grown without flood damage. Deep floodwater, however, may cover crops during periods in the growing season when rainfall is heavy. The frequent flooding in spring may damage wheat. It scours some areas, destroying planted crops. Tilth is good, but the surface layer crusts after hard rains. A system of conservation tillage that leaves crop residue on the surface minimizes crusting and increases the rate of water infiltration.

This soil is well suited to pasture. Overgrazing or grazing when the soil is wet, however, causes compaction and reduces forage yields. Proper stocking rates, pasture rotation, and restricted grazing when the soil is wet help to keep the pasture in good condition. In some areas riprap or a plant cover is needed to reduce the hazard of streambank erosion. Floodwater can prohibit grazing for short periods and can deposit sediments that reduce the quality of the forage.

This soil is well suited to trees and to habitat for openland and woodland wildlife. Floodwater generally does not damage trees. Selecting seedlings that have been transplanted once reduces the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil generally is unsuitable as a site for buildings, septic tank absorption fields, and intensive recreational uses because of the flooding. It is a good source of topsoil. Special measures are needed in some areas to keep streams from forming new channels.

The land capability classification is IIw. The woodland ordination symbol is 4A. The pasture and hayland suitability group is A-5.

**LoB2—Loudon silt loam, 3 to 8 percent slopes, eroded.** This deep, gently sloping, moderately well drained soil is on knolls and ridgetops and at the head of drainageways on the Illinoian till plain. Erosion has removed part of the original surface layer, and subsoil material has been tilled into the present surface layer. Most areas are irregularly shaped and range from 5 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 52 inches thick. The upper part is yellowish brown, mottled, firm silty clay loam. The next part is strong brown, mottled, firm clay. The lower part is yellowish brown and dark yellowish brown, mottled, very firm silty clay and clay having interbedded calcareous shale and limestone. Bedrock is at a depth of about 59 inches. In some areas the soil is well drained.

Included with this soil in mapping are small areas of the well drained, sloping Jessup soils; sloping soils on the lower parts of the landscape; and nearly level soils on the higher parts. Also included are Rossmoyne soils in landscape positions similar to those of the Loudon soil; areas of the nearly level, somewhat poorly drained Avonburg soils in slight depressions; and narrow strips of strongly sloping soils along drainageways. Rossmoyne soils have a fragipan. Included soils make up about 15 percent of most areas.

Permeability is slow in the Loudon soil. Available water capacity is high or moderate. Runoff is medium. The seasonal high water table is at a depth of 24 to 42 inches during extended wet periods. The organic matter content is moderately low. The shrink-swell potential is moderate, and the potential for frost action is high.

Most areas are used for cultivated crops or pasture. Some of the acreage is woodland or idle land.

This soil is well suited to corn, tobacco, soybeans, and small grain and to grasses and legumes for hay and pasture. The surface layer crusts after hard rains. The hazard of erosion is moderate, especially in areas that have been plowed in the fall. No-till planting or

another system of conservation tillage, grassed waterways, and a cropping sequence that includes grasses and legumes can help to control erosion and minimize crusting. The soil is well suited to no-till farming. Overgrazing or grazing when the soil is wet causes surface compaction, increases the runoff rate, and reduces yields. Deferment of grazing during wet periods helps to keep the pasture in good condition.

This soil is well suited to trees. Frequent, light thinning and harvesting can increase the vigor of the stand and reduce the hazard of windthrow. Selecting seedlings that have been transplanted once and planting early in spring reduce the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is only moderately well suited to most kinds of building site development and poorly suited to septic tank absorption fields because of the seasonal wetness, the moderate shrink-swell potential, and the slow permeability. It is better suited to buildings without basements than to buildings with basements. Outlets for subsurface and surface drains generally are available. Installing subsurface drains at the base of footings, sealing the exterior of basement walls, properly shaping the site, and draining roof water away from the building help to prevent wetness in basements and crawl spaces. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the damage caused by shrinking and swelling. Installing perimeter drains, properly grading the site, increasing the size of the absorption area, and widening the bottom of the trench help to overcome the slow permeability and wetness in septic tank absorption fields. Coating steel and concrete minimizes the damage caused by the corrosive effects of this soil. Excavation is difficult in some included areas because of the depth to interbedded shale and limestone bedrock.

Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material and by installing a drainage system.

The land capability classification is IIe. The woodland ordination symbol is 4C. The pasture and hayland suitability group is A-6.

**LwB2—Lowell silt loam, 3 to 8 percent slopes, eroded.** This deep, gently sloping, well drained soil is on the tops of ridges on unglaciated uplands. Erosion has removed part of the original surface layer, and subsoil material has been tilled into the present surface layer. Most areas are long and narrow and range from 2 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown, firm silty clay loam. The lower part is yellowish brown, dark yellowish brown, and light olive brown, mottled, firm silty clay and clay. Interbedded shale and limestone bedrock is at a depth of about 44 inches. In some areas the soil is moderately deep.

Included with this soil in mapping are small areas of nearly level soils on the crest of ridges. Also included, on shoulder slopes, are small areas of strongly sloping soils that are moderately deep over bedrock. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in the Lowell soil. Available water capacity is moderate. Runoff is medium. The organic matter content is moderately low. The shrink-swell potential is moderate.

Most areas are used for pasture or tobacco. This soil is well suited to tobacco, corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The hazard of erosion is moderate in cultivated areas. A system of conservation tillage that leaves crop residue on the surface, cover crops, and a cropping sequence that includes grasses and legumes help to control erosion, improve tilth, and increase the content of organic matter. The soil is well suited to no-till farming. Because of good natural drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown on this soil.

This soil is well suited to trees. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is only moderately well suited to building site development and poorly suited to septic tank absorption fields because of the moderately slow permeability, the moderate shrink-swell potential, and the depth to bedrock. Excavating the underlying limestone and shale bedrock is difficult, although it can be ripped and rarely requires blasting. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the damage caused by shrinking and swelling. On sites for septic tank absorption fields, the moderately slow permeability generally can be overcome by alternating the distribution of effluent into two absorption fields, increasing the size of the absorption field, or widening the bottom of the trench in the absorption field. Coating steel and concrete minimizes the damage caused by the corrosive effects of this soil.

Low strength is a limitation on sites for local roads and streets. The damage caused by this limitation can be minimized by providing suitable base material.

The land capability classification is IIe. The woodland ordination symbol is 5A. The pasture and hayland suitability group is A-1.

**No—Nolin silt loam, occasionally flooded.** This deep, nearly level, well drained soil is on flood plains. It generally is at the highest elevation on the flood plains. Flooding commonly occurs for brief periods in winter and spring, but it can occur at any time of the year. Slopes are 0 to 2 percent. Most areas are broad and elongated and range from 20 to 60 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 43 inches thick. The upper part is brown, friable silt loam. The lower part is brown, firm silty clay loam. The substratum to a depth of about 72 inches is brown, friable loam. In a few areas the soil has a surface layer of loam and has less clay between depths of 10 and 40 inches.

Included with this soil in mapping are small areas of Elkinsville soils on the slightly higher outwash terraces. Also included are soils that have short, nearly continuous slopes ranging from 10 to 25 percent. These soils are adjacent to the Ohio River. They generally are loam or sandy loam throughout. Included soils make up about 10 percent of most areas.

Permeability is moderate in the Nolin soil. Available water capacity is high. Runoff is slow. A seasonal high water table is at a depth of 36 to 72 inches during extended wet periods. The organic matter content is moderate. The potential for frost action is high.

Most areas are used for corn, tobacco, soybeans, wheat, or hay. A few are used as woodland.

This soil is well suited to cropland. Corn, tobacco, and soybeans can usually be grown without flood damage. Flooding in winter and spring, however, can damage winter wheat. The soil is well suited to irrigation. Tilth is good, but the surface layer crusts after hard rains. A system of conservation tillage that leaves crop residue on the surface minimizes crusting and increases the rate of water infiltration. Floodwater causes scouring in some areas, destroying planted crops and removing topsoil and applied plant nutrients and pesticides. In some areas riprap or a plant cover is needed to reduce the hazard of streambank erosion.

This soil is well suited to pasture (fig. 7). Overgrazing or grazing when the soil is wet, however, causes compaction and reduces forage yields. Proper stocking rates, pasture rotation, and restricted grazing when the soil is wet help to keep the pasture in good condition. Floodwater can prohibit grazing for short periods and can deposit sediments that reduce the quality of the forage.

This soil is well suited to trees and to habitat for openland and woodland wildlife. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil generally is unsuitable as a site for buildings, septic tank absorption fields, local roads and streets, and intensive recreational uses because of flooding, frost action, and low strength. It is a good source of topsoil. Special measures are needed in some areas to keep streams from forming new channels.

The land capability classification is IIw. The woodland ordination symbol is 5A. The pasture and hayland suitability group is A-5.

**PaC2—Pate silty clay, 8 to 15 percent slopes, eroded.** This deep, strongly sloping, moderately well drained and well drained soil is on colluvial toe slopes. Erosion has removed part of the original surface layer, and subsoil material has been tilled into the present surface layer. Most areas are long and narrow and range from 10 to 60 acres in size.

Typically, the surface layer is brown, friable silty clay about 8 inches thick. The subsoil is about 67 inches thick. The upper part is brown, firm silty clay. The lower part is olive brown, very firm flaggy silty clay. Rippable, interbedded light olive brown shale and gray limestone bedrock is at a depth of about 75 inches. In some areas the soil is moderately deep.

Included with this soil in mapping are small areas of moderately steep soils and many areas of gently sloping soils on roughly parallel, long, narrow benches. Included soils make up about 15 percent of most areas.

Permeability is very slow in the Pate soil. Available water capacity is low or moderate. Runoff is rapid. The organic matter content is moderately low or moderate. The shrink-swell potential is high.

Most areas are used as pasture. Some of the less sloping areas that formerly were cultivated are now used as brushy pasture.

This soil is moderately well suited to cropland and well suited to pasture. It is better suited to grasses than to legumes because of the shrinking and swelling and the high content of clay in the surface layer. Controlling erosion and maintaining a good stand of forage species are the major management concerns. No-till farming or another system of conservation tillage that leaves crop residue on the surface helps to control erosion. If pastured areas are overgrazed or reseeded by conventional tillage methods, erosion is a severe hazard. Cover crops, companion crops, or no-till seeding methods help to control erosion during reseeding. Proper stocking rates, pasture rotation, and timely applications of fertilizer help to maintain a good stand of forage species.

This soil is well suited to trees. Planting techniques that spread the roots of the seedlings and improve the soil-root contact reduce the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Frequent, light

**Figure 7.—A pastured area of Nolin silt loam, occasionally flooded. Pate and Eden soils are on the hillside in the background.**

thinning and harvesting can increase the vigor of the stand and reduce the hazard of windthrow.

This soil is poorly suited to building site development and generally is unsuitable as a site for septic tank absorption fields because of the high shrink-swell potential and the very slow permeability. Backfilling along foundations with material that has a low shrink-swell potential, designing walls that have pilasters, and reinforcing walls and foundations help to prevent the damage caused by shrinking and swelling. Ground water seepage over the nearly impervious shale bedrock can result in wet basements and seepy excavations. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Deep cuts are subject to slippage. Coating steel and concrete minimizes the damage caused by the corrosive effects of this soil. Septic tank absorption fields should be located on the better suited surrounding soils.

Low strength and the high shrink-swell potential are limitations on sites for local roads and streets. Providing suitable base material helps to prevent the damage resulting from these limitations. Cuts made into this soil expose the clayey and stony material, which is sticky when wet and hard when dry. Grading the clayey material is difficult.

The land capability classification is IIIe. The woodland ordination symbol is 5C. The pasture and hayland suitability group is A-1.

**PaD2—Pate silty clay, 15 to 25 percent slopes, eroded.** This deep, moderately steep, moderately well drained and well drained soil is in colluvial areas on the lower third of hillsides. Hillside slips are common.

Erosion has removed part of the original surface layer, and subsoil material has been tilled into the present surface layer. Most areas are long and narrow and range from 20 to 100 acres in size.

Typically, the surface layer is dark brown, friable silty clay about 4 inches thick. The subsoil is about 71 inches thick. The upper part is brown, firm silty clay, and the lower part is dark grayish brown and olive brown, very firm flaggy silty clay. Rippable, interbedded light olive brown shale and gray limestone bedrock is at a depth of about 75 inches. In some areas the soil is moderately deep.

Included with this soil in mapping are small areas of steep soils. Also included are areas of gently sloping soils on narrow benches that are roughly on the contour and a few small areas of bedrock outcrops. Inclusions make up about 15 percent of most areas.

Permeability is very slow in the Pate soil. Available water capacity is low or moderate. Runoff is very rapid. The organic matter content is moderately low or moderate. The shrink-swell potential is high.

Most areas are used as pasture. A few are used as woodland. This soil is poorly suited to pasture and generally is unsuited to cropland because of the slope and a severe hazard of erosion. If the pasture is overgrazed or plowed during seedbed preparation, erosion is a severe hazard. Growing cover or companion crops, mulching, and no-till seeding reduce the risk of erosion. Proper stocking rates, pasture rotation, and timely applications of fertilizer help to maintain a good stand of forage species.

This soil is well suited to woodland. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Frequent, light thinning and harvesting can increase the vigor of the stand and reduce the hazard of windthrow. Planting techniques that spread the roots of the seedlings and improve the soil-root contact reduce the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil generally is unsuitable as a site for buildings and septic tank absorption fields because of the slope, the high shrink-swell potential, and the very slow permeability.

The slope, low strength, and the high shrink-swell potential are limitations on sites for local roads and streets. The damage caused by low strength and by shrinking and swelling can be minimized by providing suitable base material. Building the roads and streets across the slope reduces the gradient and helps to control erosion.

The land capability classification is VIe. The woodland ordination symbol is 5R. The pasture and hayland suitability group is A-2.

**PaE2—Pate silty clay, 25 to 35 percent slopes, eroded.** This deep, steep, moderately well drained and well drained soil is in colluvial areas on the lower third of hillsides. Erosion has removed part of the original surface layer, and subsoil material has been tilled into the present surface layer. Slopes are uneven, and some areas have hillside slips. Most areas are long and narrow and range from 15 to 150 acres in size.

Typically, the surface layer is dark brown, firm silty clay about 4 inches thick. The subsoil is about 71 inches thick. The upper part is brown, firm silty clay, and the lower part is dark grayish brown and olive brown, very firm flaggy silty clay. Rippable, interbedded light olive brown shale and gray limestone bedrock is at a depth of about 75 inches. In some areas the soil is moderately deep.

Included with this soil in mapping are small areas of moderately steep soils. Also included are gently sloping soils on narrow benches that are roughly on the contour and a few areas of bedrock outcrops. Inclusions make up about 15 percent of most areas.

Permeability is very slow in the Pate soil. Available water capacity is low or moderate. Runoff is very rapid. The organic matter content is moderate or moderately low. The shrink-swell potential is high.

Most areas are used as woodland or pasture. This soil generally is unsuited to pasture and cropland. In overgrazed areas erosion is a very severe hazard.

This soil is well suited to trees. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Frequent, light thinning and harvesting can increase the vigor of the stand and reduce the hazard of windthrow. Planting techniques that spread the roots of the seedlings and improve the soil-root contact reduce the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil generally is unsuitable as a site for buildings and septic tank absorption fields because of the slope, the high shrink-swell potential, hillside slippage, and the very slow permeability. Areas that have been cut and filled are especially subject to slippage.

The land capability classification is VIIe. The woodland ordination symbol is 5R. The pasture and hayland suitability group is A-3.

**RpB—Rossmoyne silt loam, 1 to 6 percent slopes.** This deep, gently sloping, moderately well drained soil is on knolls and low ridges and at the head of drainageways on the Illinoian till plain. Areas are irregularly shaped and range from 5 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 65 inches thick. It is yellowish brown. It is mottled below a depth of about 15 inches. The upper part is friable silty clay loam, the next part is a fragipan of very firm clay loam, and the lower part is firm clay loam. The substratum to a depth of about 78 inches is yellowish brown, mottled, very firm loam. In some areas the soil does not have a fragipan. In a number of areas, it is eroded. In a few places the substratum has thin layers of sandy loam. In some areas the soil is sloping.

Included with this soil in mapping are areas of the somewhat poorly drained Avonburg and poorly drained Clermont soils on nearly level parts of the landscape, on toe slopes, and along drainageways and Loudon soils in scattered small areas where the silty mantle is thinner and interbedded limestone and shale bedrock is closer to the surface. Also included, along shallow waterways, are a few short, sloping areas of severely eroded soils in which tilth is poor. Included soils make up about 15 percent of most areas.

Permeability is moderate in the upper part of the Rossmoyne soil and slow or moderately slow in the fragipan. Root growth is restricted mainly to the zone above the fragipan. Available water capacity is low in this zone. Runoff is medium. A perched seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. The organic matter content is moderate. The shrink-swell potential also is moderate, and the potential for frost action is high.

Most areas are used as cropland. Some are used as pasture. This soil is well suited to corn, soybeans, tobacco, wheat, oats, and hay. Maintaining the organic matter content and reducing the hazard of erosion are the main management concerns. The surface layer crusts after hard rains. A system of conservation tillage that leaves crop residue on the surface, contour farming, and cover crops reduce the hazard of erosion. The soil is well suited to conservation tillage, including no-till farming (fig. 8). Grassed waterways help to control erosion in areas where runoff concentrates. Returning crop residue to the soil improves tilth, minimizes crusting, and increases the rate of water infiltration. Natural drainage generally is adequate for farming, but scattered subsurface drains are needed in the wetter included areas.

This soil is well suited to pasture. Grazing when the soil is wet, however, causes compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and restricted grazing when the soil is wet help to keep the pasture in good condition. Maintaining stands of deep-rooted legumes is difficult because of the limited depth to the top of the fragipan and the potential for frost action.

This soil is moderately well suited to woodland. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced reduce the hazard of windthrow. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is only moderately well suited to building site development because of the seasonal wetness and the moderate shrink-swell potential. Because of the seasonal wetness, it is better suited to houses without basements than to houses with basements. Building sites should be landscaped so that surface water drains away from foundations and septic tank absorption fields. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Backfilling excavations along basement walls and foundations with material that has a low shrink-swell potential minimizes the damage caused by shrinking and swelling. Coating steel and concrete minimizes the damage caused by the corrosive effects of this soil.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow or moderately slow permeability. Perimeter drains around the absorption fields lower the seasonal high water table and intercept lateral seepage along the top of the fragipan. Enlarging the absorption field and installing the distribution lines as shallow as possible in the zone above the fragipan help to overcome the restricted permeability. The absorption fields should be located on the higher parts of the landscape.

Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material and by installing a drainage system. The soil is well suited to embankment ponds used for recreation, water supply, and fire protection (fig. 9).

The land capability classification is IIe. The woodland ordination symbol is 3D. The pasture and hayland suitability group is F-3.

**RpC2—Rossmoyne silt loam, 6 to 12 percent slopes, eroded.** This deep, sloping, moderately well drained soil is on side slopes along drainageways on the Illinoian till plain. Erosion has removed part of the original surface layer, and subsoil material has been tilled into the present surface layer. Areas are irregularly shaped and range from 5 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 60 inches thick. It is yellowish brown. It is mottled below a depth of about 15 inches. The upper part is friable silty clay loam, the next part is a fragipan of very firm and firm clay loam, and the lower part is firm clay loam. The substratum to a depth of about 75 inches is yellowish

Figure 8.—No-till corn in an area of Rossmoyne silt loam, 1 to 6 percent slopes.

brown, very firm loam. In some areas the soil does not have a fragipan. In other areas thin layers of sandy loam are below a depth of about 80 inches. In places the soil is gently sloping. In a few areas it is well drained.

Included with this soil in mapping are the well drained Jessup and Loudon soils in scattered small areas where interbedded limestone and shale bedrock is closer to the surface and the somewhat poorly drained Avonburg soils on toe slopes and along drainageways. Also included, on short, steep slopes, are small areas of severely eroded soils that have a surface layer of silty clay loam in which tilth is poor. Included soils make up about 15 percent of most areas.

Permeability is moderate in the upper part of the Rossmoyne soil and slow or moderately slow in the fragipan. Root growth is restricted mainly to the zone above the fragipan. Available water capacity is low in this zone. Runoff is rapid. A perched seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. The organic matter content is moderately low. The shrink-swell potential is moderate, and the potential for frost action is high.

Most areas are used as pasture. Some are used as cropland. This soil is moderately well suited to corn, soybeans, tobacco, wheat, oats, and hay and is well suited to pasture. Erosion is a severe hazard in cultivated areas. The surface layer crusts after hard rains. No-till farming or another system of conservation tillage that leaves crop residue on the surface, grassed waterways, cover crops, and a cropping sequence that includes grasses and legumes minimize crusting and

**Figure 9.—A pond in an area of Rossmoyne silt loam, 1 to 6 percent slopes. This soil is well suited to embankment ponds.**

erosion. Overgrazing or grazing when the soil is wet causes compaction, increases the runoff rate, and reduces yields. Pasture rotation and restricted grazing when the soil is wet help to keep the pasture in good condition. No-till seeding and growing cover or companion crops during periods when the pasture is becoming established help to control erosion. Including fibrous-rooted grasses in the seeding mixture protects the legumes from frost heaving.

This soil is moderately well suited to woodland. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced reduce the hazard of windthrow. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is poorly suited to building site development because of the slope, the seasonal wetness, and the moderate shrink-swell potential. It is better suited to houses without basements than to houses with basements because of the seasonal wetness. Designing buildings so that they conform to the natural slope of the land minimizes the need for cutting and filling. Installing drains at the base of footings and coating the

exterior of basement walls help to keep basements dry. Backfilling excavations along basement walls and foundations with material that has a low shrink-swell potential minimizes the damage caused by shrinking and swelling. Coating steel and concrete minimizes the damage caused by the corrosive effects of this soil.

This soil is poorly suited to septic tank absorption fields because of the slope, the seasonal wetness, and the slow or moderately slow permeability. Perimeter drains around the absorption fields lower the seasonal high water table and intercept lateral seepage along the top of the fragipan. Enlarging the absorption fields and installing the distribution lines as shallow as possible in the zone above the fragipan help to overcome the restricted permeability. Installing the distribution lines across the slope helps to prevent excessive seepage of the effluent to the surface.

Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material and by installing a drainage system.

The land capability classification is IIIe. The woodland ordination symbol is 3D. The pasture and hayland suitability group is F-3.

**RwC3—Rossmoyne-Bonnell complex, 6 to 12 percent slopes, severely eroded.** These deep, sloping, moderately well drained and well drained soils are on side slopes along drainageways on the Illinoian till plain. The Rossmoyne soil generally is on the upper part of the slopes and in the least sloping areas. The Bonnell soil generally is on the lower part of the slopes, on slope breaks, and in the more sloping areas. Erosion has removed most or all of the original surface layer, and subsoil material has been tilled into the present surface layer. Shallow gullies and scoured areas are common. Most areas are irregularly shaped and are 5 to 20 acres in size. They are about 50 percent Rossmoyne silt loam and 35 percent Bonnell clay loam. The two soils occur as areas so intricately mixed or so small in size that separating them in mapping is not practical.

Typically, the surface layer of the Rossmoyne soil is yellowish brown, friable silty clay loam about 5 inches thick. The subsoil is about 55 inches thick. It is yellowish brown. It is mottled below a depth of about 15 inches. The upper part is firm silty clay loam, the next part is a fragipan of very firm clay loam, and the lower part is firm clay loam. The substratum to a depth of about 68 inches is yellowish brown, very firm loam. In a few places the soil is so severely eroded that the fragipan is within 12 inches of the surface. In some areas the soil is gently sloping. In a few areas the surface layer is silt loam. In places the soil does not have a fragipan.

Typically, the surface layer of the Bonnell soil is dark yellowish brown, friable clay loam about 5 inches thick. The subsoil is about 27 inches of dark yellowish brown, firm clay and yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, very firm clay loam and loam. In a few areas the soil is moderately steep. In some areas it is moderately well drained. In other areas the subsoil has less clay. In a few places the substratum formed in material weathered from limestone and shale.

Included with these soils in mapping are Loudon soils in scattered small areas where interbedded limestone and shale bedrock is closer to the surface and Avonburg soils on toe slopes and in small drainageways. Also included, on the lower parts of the slopes, are a few areas of soils that have a surface layer of gravelly clay loam. Included soils make up about 15 percent of most areas.

Permeability is moderate in the upper part of the Rossmoyne soil and moderately slow or slow in the fragipan. It is slow in the Bonnell soil. The Rossmoyne soil has a perched seasonal high water table at a depth of 18 to 36 inches during extended wet periods. The root zone is restricted mainly to the layers above the fragipan in the Rossmoyne soil and is deep in the Bonnell soil. Available water capacity is very low in the root zone of the Rossmoyne soil and moderate in the Bonnell soil. Runoff is rapid on both soils. The organic matter content is low. The shrink-swell potential is moderate in the Rossmoyne soil and high in the Bonnell soil. The potential for frost action is high in the Rossmoyne soil and moderate in the Bonnell soil.

Most areas are used as pasture. A small acreage is used for cultivated crops or is idle land. A few areas are used as woodland.

These soils are poorly suited to corn and small grain and are moderately well suited to grasses and legumes for hay and pasture. The hazard of erosion is severe, especially in areas that are plowed. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer to maintain productivity. Measures that help to control erosion and increase the organic matter content include a system of conservation tillage that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, and grassed waterways. No-till methods of pasture seeding help to control erosion during reseeding. Overgrazing or grazing when the soils are wet causes compaction, increases the runoff rate, and reduces yields. Pasture rotation and restricted grazing when the soils are wet help to keep the pasture in good condition.

These soils are moderately well suited to woodland. Planting techniques that spread the roots of the seedlings and increase soil-root contact reduce the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Frequent, light thinning and harvesting can increase the vigor of the stand and reduce the hazard of windthrow.

These soils are poorly suited to building site development because of the shrink-swell potential and slope of both soils and the seasonal wetness in the Rossmoyne soil. Installing drains at the base of footings and coating the exterior of basement walls help to prevent wetness in basements and crawl spaces. Designing buildings so that they conform to the natural slope of the land minimizes the need for cutting and filling. Designing walls that have pilasters, reinforcing walls and foundations, supporting the walls with a large spread footing, and backfilling along foundations and basement walls with material that has a low shrink-swell potential help to prevent the damage caused by shrinking and swelling. Coating steel and concrete minimizes the damage caused by the corrosive effects of these soils.

These soils are poorly suited to septic tank absorption fields because of the restricted permeability and slope of both soils and the seasonal wetness in the Rossmoyne soil. Enlarging the absorption fields and installing the distribution lines as shallow as possible or in suitable fill material can help to overcome the restricted permeability. Installing interceptor drains upslope from the absorption field reduces the seasonal wetness. Installing the distribution lines across the slope helps to prevent excessive seepage of the effluent to the surface.

Low strength and frost action in the Rossmoyne soil and low strength and the high shrink-swell potential in the Bonnell soil are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material and by installing a drainage system.

The land capability classification is IVe. The woodland ordination symbol assigned to the Rossmoyne soil is 3D, and that assigned to the Bonnell soil is 3C. The pasture and hayland suitability group assigned to the Rossmoyne soil is F-3, and that assigned to the Bonnell soil is A-1.

**SaB—Sardinia silt loam, 1 to 6 percent slopes.** This deep, gently sloping, moderately well drained soil is in plane or slightly concave areas on terraces in valleys. Most areas are elongated and range from 5 to 35 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 55 inches thick. The upper part is brown, friable silt loam; the next part is dark yellowish brown, mottled, firm silty clay loam; and the lower part is dark yellowish brown and yellowish brown, mottled, firm clay loam. The substratum to a depth of about 80 inches is yellowish brown and grayish brown, friable sandy clay loam. In some areas the soil is well drained. In a few areas, the soil is eroded and tilth is poor.

Included with this soil in mapping are a few scattered areas of somewhat poorly drained soils. These soils make up about 5 percent of most areas.

Permeability is moderate or moderately slow in the Sardinia soil. Available water capacity is high. Runoff is slow or medium. A perched seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. The organic matter content is moderate. The shrink-swell potential also is moderate, and the potential for frost action is high.

Most areas are used as cropland. A few are used as pasture or woodland. This soil is well suited to corn, tobacco, soybeans, and small grain and to grasses and legumes for hay and pasture. The hazard of erosion is moderate in cultivated areas. Subsurface drains are used to lower the seasonal high water table in some of the wetter areas. The surface layer crusts after hard rains. Grassed waterways, a system of conservation tillage that leaves crop residue on the surface most of the year, cover crops, and a cropping sequence that includes grasses and legumes help to control erosion, increase the rate of water infiltration, minimize crusting, improve tilth, and increase the organic matter content. Timely applications of lime and fertilizer help to maintain the stand of key forage species. Maintaining stands of deep-rooted legumes is difficult because of the high potential for frost action. Overgrazing or grazing when the soil is wet causes surface compaction, increases the runoff rate, and reduces yields.

This soil is well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is only moderately well suited to building site development and poorly suited to septic tank absorption fields because of the seasonal wetness, the moderate shrink-swell potential, and the moderate or moderately slow permeability. Installing drains at the base of footings, coating the exterior of basement walls, properly landscaping the site, and draining roof water away from the building help to prevent wetness in crawl spaces and basements. Backfilling along foundations and basement walls with material that has a low shrink-swell potential minimizes the damage caused by shrinking and swelling. Installing perimeter drains around septic tank absorption fields lowers the seasonal

high water table. Enlarging the absorption field helps to overcome the restricted permeability. Coating steel and concrete minimizes the damage caused by the corrosive effects of this soil.

Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material and by installing a drainage system.

The land capability classification is IIe. The woodland ordination symbol is 5A. The pasture and hayland suitability group is A-6.

**ScA—Sciotoville silt loam, 0 to 2 percent slopes.** This deep, nearly level, moderately well drained soil is on terraces along the Ohio River. Most areas are irregularly shaped but generally parallel the Ohio River. They range from 5 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 48 inches thick. It is mottled below a depth of about 18 inches. The upper part is brown, friable and firm silt loam and silty clay loam. The next part is a fragipan of brown, very firm silt loam. The lower part is brown, firm loam. The substratum to a depth of about 60 inches is brown, friable loam that has strata of silt loam and fine sandy loam. In some areas the subsoil does not have a fragipan. In a few areas the soil is gently sloping.

Included with this soil in mapping are Elkinsville soils on the higher rises and Nolin soils on the lower parts of the landscape. Also included are a few scattered areas of somewhat poorly drained soils and some areas of soils that are subject to rare flooding. Included soils make up about 15 percent of most areas.

Permeability is moderate in the upper part of the Sciotoville soil and slow or moderately slow in the fragipan. Available water capacity is high. Runoff is slow. A perched seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. The root zone is moderately deep over the fragipan. The organic matter content is moderate. The potential for frost action is high.

Most areas are used as cropland. A few are used as pasture or woodland. This soil is well suited to tobacco, corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The seasonal wetness is the major limitation. Subsurface drains are used in some areas. The surface layer crusts after hard rains. Conservation tillage and a cropping sequence that includes meadow crops minimize crusting. Overgrazing or grazing when the soil is wet causes compaction and poor tilth. Proper stocking rates, pasture rotation, and mowing to control weeds help to keep the pasture in good condition. Maintaining stands of deep-rooted legumes is difficult because of depth to the fragipan and the potential for frost action. Including fibrous-rooted grasses in the seeding mixture protects the legumes from frost heaving.

This soil is well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is only moderately well suited to building site development and poorly suited to septic tank absorption fields because of the seasonal wetness and the slow or moderately slow permeability. Installing drains at the base of footings, coating the exterior of basement walls, and draining roof water away from the building help to prevent wetness in basements and crawl spaces. Installing perimeter drains around septic tank absorption fields lowers the seasonal high water table. Enlarging the absorption field helps to overcome the restricted permeability. Properly landscaping building sites and absorption fields results in good surface drainage. Coating concrete and steel minimizes the damage caused by the corrosive effects of this soil. Careful site selection is needed because of the included soils that are subject to rare flooding, which can cause severe damage.

Frost action is a limitation on sites for local roads and streets. The damage caused by this limitation can be minimized by providing suitable base material and by installing a drainage system.

The land capability classification is IIw. The woodland ordination symbol is 4A. The pasture and hayland suitability group is F-3.

**Sh—Shoals silt loam, frequently flooded.** This deep, nearly level, somewhat poorly drained soil is on flood plains. It is frequently flooded for brief periods. Slopes are 0 to 2 percent. Most areas are long and narrow and range from 5 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The upper part of the substratum is brown, yellowish brown, and light brownish gray, mottled, friable loam about 22 inches thick. The lower part to a depth of about 60 inches is grayish brown, dark yellowish brown, and yellowish brown, mottled, firm loam and sandy loam. In some areas the soil is poorly drained.

Included with this soil in mapping are soils that are only rarely flooded. These soils are in the higher areas. Also included are the well drained Genesee soils on slight rises. Included soils make up about 15 percent of most areas.

Permeability is moderate in the Shoals soil. Available water capacity is high. Runoff is slow. The seasonal high water table is at a depth of 6 to 18 inches during extended wet periods. The organic matter content is

moderate. The potential for frost action is high.

Most areas are used as cropland. If drained, this soil is well suited to corn, tobacco, soybeans, and specialty crops. Flooding in winter and spring can damage winter wheat, but corn, tobacco, and soybeans can usually be grown without flood damage. The wetness delays planting in most years. Subsurface drains are used to lower the seasonal high water table in areas where good outlets are available. Floodwater scours some areas, carrying away topsoil and recently applied plant nutrients.

This soil is well suited to pasture. Because of the seasonal wetness, it is better suited to grasses than to legumes. Overgrazing or grazing when the soil is wet causes compaction and reduces forage yields. Proper stocking rates, pasture rotation, and restricted grazing when the soil is wet help to keep the pasture in good condition. Grazing is good through the dry part of the summer. Floodwater prohibits grazing for short periods and deposits sediments on the plants, reducing the quality of the forage.

This soil is well suited to woodland. Selecting seedlings that have been transplanted once reduces the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil generally is unsuitable as a site for buildings, septic tank absorption fields, and intensive recreational uses because of the flooding and the seasonal wetness. Placing riprap on streambanks or vegetating the streambanks reduces the hazard of erosion in some areas.

The land capability classification is IIw. The woodland ordination symbol is 5A. The pasture and hayland suitability group is C-3.

**WvB—Williamsburg silt loam, 2 to 6 percent slopes.** This deep, gently sloping, well drained soil is in plane or convex areas on terraces in valleys. Most areas are elongated or roughly circular and range from 5 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The upper part of the subsoil is brown and dark yellowish brown, friable silt loam. The next part is dark yellowish brown, firm sandy clay loam. The lower part to a depth of about 80 inches is brown, mottled, firm sandy clay loam.

Included with this soil in mapping are some areas of moderately well drained soils in slight depressions and drainageways. Also included are short, sloping areas where erosion has removed part or all of the original surface layer and subsoil material has been tilled into the present surface layer. Tilth is poor in these areas, and the areas appear yellowish brown in a farmed field. Included soils make up about 10 percent of most areas.

Permeability is moderate in the Williamsburg soil. Available water capacity is high. Runoff is slow or medium. The organic matter content is moderate. The shrink-swell potential also is moderate.

Most areas are used as cropland. A few are used as pasture or woodland. This soil is well suited to corn, tobacco, soybeans, and small grain and to grasses and legumes for hay and pasture. The hazard of erosion is moderate in tilled areas. The soil warms and dries early in spring and thus is well suited to early planting. The surface layer crusts after hard rains. No-till farming or another system of conservation tillage that leaves crop residue on the surface and a cropping sequence that includes grasses and legumes help to control erosion and minimize crusting. The soil is well suited to no-till farming. Because of good natural drainage, it is well suited to grazing in winter and early in spring. Alfalfa grows well in limed areas.

This soil is well suited to trees. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is well suited to building site development and septic tank absorption fields. The moderate shrink-swell potential is a limitation on sites for buildings. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the damage caused by shrinking and swelling. The included moderately well drained soils are poorly suited to buildings with basements because of the seasonal wetness.

Low strength is a limitation on sites for local roads and streets. Replacing the surface layer and subsoil with suitable base material minimizes the damage caused by low strength.

The land capability classification is IIe. The woodland ordination symbol is 5A. The pasture and hayland suitability group is A-1.

## Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be

cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 126,500 acres in Brown County, or more than 40 percent of the total acreage, is prime farmland. This land is mainly in associations 1, 2, 4, and 5, which are described under the heading "General Soil Map Units." Most of the acreage in the valley of the Ohio River, on the Illinoian till plain in the northern and central parts of the county, and in the secondary stream valleys is prime farmland. Most of the prime farmland is used as cropland.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is given in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units."

Some soils that have a seasonal high water table and all soils that are frequently flooded during the growing season qualify for prime farmland only in areas where these limitations have been overcome by drainage measures or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

# Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to various interpretive groups at the end of each map unit description and in some of the tables. The groups for each map unit also are shown in the section "Interpretive Groups," which follows the tables at the back of this survey.

## Crops and Pasture

Robert L. Hendershot, area agronomist, Soil Conservation Serv ce, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1982, more than 194,000 acres in Brown County was used for crops or pasture *(15)*. Of this total, about 89,000 acres was used for row crops, mainly corn and soybeans; 10,000 acres for close-growing crops, mainly wheat; 4,100 acres for tobacco; 16,000 acres for hay; 3,400 acres for rotational hay and pasture; and 41,000 acres for pasture *(16)*. The remaining acreage was idle cropland or pasture.

The potential of the soils in Brown County for grain crops and pasture is good. Production can be increased by using the information in this survey and the latest production techniques. Some of the acreage that commonly is pastured or wooded also has good potential for grain crops and pasture. The feasibility of converting pasture to grain production or woodland to pasture or cropland depends on economic and environmental considerations.

The acreage used for crops and pasture in Brown County has not been changed greatly because of urban development. About 26,000 acres in the county is urban or built-up land. This figure increased by about 2,500 acres between 1977 and 1982.

The main management needs on the cropland and pasture in the county are measures that help to control erosion, reduce wetness, and maintain fertility and tilth.

*Erosion* is a major problem in Brown County. Conservation treatment is needed on about 41 percent of the cropland and 66 percent of the pasture in the county *(15)*. Even in nearly level areas, erosion can reduce productivity or interfere with fieldwork. In areas where slopes are more than 2 percent, special conservation practices are needed to keep erosion from reducing productivity or increasing the cost of production. Productivity is reduced if the surface layer is lost and part of the subsoil is incorporated into the plow layer. In Faywood, Loudon, Lowell, and other soils, loss of the surface layer can expose a clayey subsoil. Tilth is poor in this clayey material. Erosion also reduces the productivity of soils that tend to be droughty, such as Faywood and Pate soils, because it reduces the available water capacity.

Erosion increases the cost of production because many of the plant nutrients in commercial fertilizer or in organic material that is added to the soil are held by the soil particles in the surface layer. Erosion removes these nutrients along with the soil particles.

Erosion on farmland results in the pollution of streams by sediments and nutrients. Reducing the hazard of erosion minimizes this pollution and improves the quality of water for municipal and recreational uses and for fish and wildlife.

In many of the more eroded spots in gently sloping and strongly sloping fields, tilling and preparing a good seedbed are difficult because most of the original surface layer has been lost. A limited seed-soil contact and a reduced available water capacity in the more eroded spots result in poor stands. These spots are common in areas of the eroded Avonburg, Elkinsville, Loudon, Lowell, and Rossmoyne soils.

Erosion-control practices commonly provide a protective cover, help to control runoff, and increase the rate of water infiltration. Contour farming, contour stripcropping, and terraces are effective erosion-control measures. In most areas of the county, however, slopes are too short and irregular for these measures to be practical. Avonburg, Lowell, Loudon, and Rossmoyne are examples of soils on which these measures could be applied.

A cropping system that keeps a plant cover on the soil for extended periods can hold soil losses to amounts that do not reduce the productive capacity of the soil. On livestock farms, where pasture and hay are grown in rotation with grain crops, including grasses and legumes in the cropping sequence helps to control erosion, provides nitrogen, and improves tilth.

A system of conservation tillage that leaves crop residue on the surface increases the rate of water infiltration and reduces the hazards of runoff and erosion. It is suited to most of the soils in Brown County. Somewhat poorly drained and poorly drained soils are not so well suited to no-till farming as well drained and moderately well drained soils unless a drainage system is installed.

Grassed waterways help to control erosion by holding the surface soil in place and by slowing runoff. Natural drainageways are the best sites for grassed waterways. They generally require a minimum of shaping to produce a good channel. Channels should be wide and flat, so that they can be easily crossed by farm machinery. Many areas where surface runoff is concentrated into a narrow channel or where it crosses a steeper slope can be protected by a grassed waterway.

Information about the design of erosion-control measures for each kind of soil is available at the local office of the Soil Conservation Service. Current information about tillage practices is available at the local offices of the Soil Conservation Service and the Cooperative Extension Service.

*Wetness* is a limitation on about 37 percent of the cropland in the county *(15)*. The poorly drained Blanchester and Clermont soils are so wet that yields are reduced in most years unless a drainage system is installed. A drainage system reduces the likelihood that planting dates will be delayed. Small depressional areas of these soils are subject to ponding. Field ditches or surface drains are needed where ponding is a problem.

Unless drained, the somewhat poorly drained Avonburg, Atlas, and Shoals soils dry out and warm up slowly in spring. The wetness delays planting, harvesting, and germination and reduces yields. In many years excess moisture in the root zone damages crops.

Small areas of wetter soils are commonly included with Faywood, Loudon, Lowell, and Rossmoyne soils in mapping. A drainage system is needed in some of these wetter areas.

The design of both surface and subsurface drainage systems varies, depending on the kind of soil and the availability of outlets. Drains should be closer together in slowly permeable soils than in the more permeable soils. Adequate outlets are not readily available in many areas. Information about the design of drainage systems for each kind of soil is available at the local office of the Soil Conservation Service.

*Fertility* is naturally low in most of the soils on uplands in the county. These soils are naturally acid and require applications of lime to raise the pH level enough for legumes and other crops to grow well. The supply of available phosphorus and potassium is naturally low in many of these soils. Genesee, Jules, and Nolin soils, which are on flood plains, range from medium acid to mildly alkaline and are naturally higher

in content of plant nutrients than most of the soils on uplands. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kind and amount of fertilizer and lime needed.

*Tilth* is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils with good tilth are friable and porous. Maintaining tilth is a problem in many of the soils in Brown County. In most of the soils, the surface layer is light colored silt loam that has a moderately low content of organic matter. After periods of intensive rainfall, this layer tends to crust as it dries. The crust is hard when dry and is nearly impervious to water. As a result, it reduces the rate of water infiltration and increases the hazards of runoff and erosion. If a moldboard plow is used on the soils in the fall, the surface tends to crust in winter and early spring. Consequently, the plow layer is nearly as dense and hard in the spring as it was before it was plowed in the fall. Regular additions of crop residue, manure, and other organic material are needed to maintain good soil structure and minimize crusting.

The field crops suited to the soils and climate of Brown County include many that are not commonly grown. Corn and soybeans are the main row crops. Wheat is the most common close-grown crop. Grain sorghum, sunflowers, canola, navy beans, and similar crops could be grown if economic conditions were favorable. Oats, rye, barley, and flax also could be grown. Seed could be produced from fescue, timothy, bluegrass, red clover, alsike clover, and alfalfa.

The specialty crops grown commercially in Brown County include tobacco, vegetables, small fruits, tree fruits, and nursery plants. Scattered areas throughout the county are used for strawberries, blackberries, raspberries, grapes, tomatoes, melons, peppers, cucumbers, beans, or other vegetables and small fruits. Also, the county has several vineyards, orchards, areas where trees are grown for nursery stock, and areas where Christmas trees are grown.

Deep soils that are characterized by good natural drainage and a high content of organic matter in the topsoil and that warm up early in the spring are especially well suited to many vegetables and fruits. The soils in the county that are best suited to intensively grown horticultural crops are the less sloping Elkinsville, Lowell, and Rossmoyne soils; Williamsburg, Sardinia, and Sciotoville silt loams; and, unless flooding is a problem, Nolin, Jules, Genesee, and Shoals silt loams. Crops can generally be planted and harvested earlier on these soils than on other soils. Under a high level of management that includes additions of organic material, such as green manure, mulch, or animal manure, the soils can be very productive. Care must be taken if orchard or vineyard crops or berries are planted in low areas because of the hazard of frost. Ridges and bottom land along the Ohio River are very good sites for orchards, vineyards, vegetables, and small fruits because the river moderates local weather conditions.

Tobacco is the chief specialty crop grown in the county. It can be successfully grown on a great variety of soils. Soil type, tilth, and climate affect the quality of tobacco more than they affect the quality of any other crop. Tobacco grows best on deep, friable, well drained soils, such as Elkinsville, Genesee, Jules, Nolin, and Williamsburg soils (fig. 10). Because of a low or moderate available water capacity and a moderately low content of organic matter, Faywood and Pate soils tend to produce a leaf that is relatively large, light in color and body, fine in texture, and weak in aroma.

Soils that have a fragipan, such as Cincinnati, Rossmoyne, Sardinia, and Sciotoville soils, are better suited to tobacco than to corn and alfalfa, but they are less well suited to tobacco than well drained soils that do not have a root-restricting layer *(17)*. The fragipan hinders the growth and limits the yield of tobacco on these soils. Because it is slowly or moderately slowly permeable, it limits the amount of available water in dry years and restricts root growth and increases the likelihood of disease in very wet years. Because of a high content of clay, Jessup, Loudon, and Lowell soils tend to produce a leaf that is relatively small, dark, heavy in body, and strong in aroma.

Tobacco requires good drainage. It cannot withstand waterlogged soil conditions because its roots are very sensitive to low concentrations of oxygen in the soil. Algiers, Atlas, Avonburg, Blanchester, Clermont, and Shoals soils have a seasonal high water table that can limit the supply of oxygen. Also, diseases are more common on these soils than on other soils. Crop rotations, a surface and subsurface drainage system, deferment of plowing when the soils are wet, incorporation of crop residue into the soils, cover crops, and ridge tillage help to overcome the limitations of these soils.

Tobacco is a transplanted crop. Seedlings are started from tiny seeds broadcast onto soil beds. Later, they are transplanted to the fields. They require protection against harsh weather. The beds generally are protected by some type of wind barrier, such as buildings, fence rows, hedges, and trees. Seedlings grow best on beds prepared on deep, well drained, moderately permeable soils that have a slight slope and a southern or southeastern exposure. Cincinnati, Elkinsville, Lowell, and Williamsburg soils and the

**Figure 10.—Tobacco in an area of Nolin silt loam, occasionally flooded, on a narrow flood plain. This soil is well suited to tobacco.**

included soils on the higher parts of the landscape in areas of Loudon and Rossmoyne soils are good sites for beds. In many areas the beds are prepared in the field in which the seedlings are planted. Crowning the beds in the center during tillage helps to drain off surface water.

Growing tobacco year after year tends to deplete natural fertility and breaks down soil structure. A cropping sequence that includes grasses and legumes helps to prevent diseases, control erosion, and improve tilth. Deep disking or plowing immediately after cutting and planting a cover crop help to control diseases, insects, and weeds during the following years and reduce the hazard of erosion.

Approximately 12 percent of the acreage in Brown County is used as pasture or hayland, and another 8 percent is potential pasture or hayland that is idle and is reverting to brush and trees *(15)*. Most of the pasture and hayland is on hillsides adjacent to cultivated areas of less sloping soils. The soils used for pasture and hay formed in loess, glacial till, or material weathered from shale or limestone. These soils are subject to erosion.

The dominant forage species are bluegrass and tall grasses, including tall fescue, orchardgrass, and timothy. Many of the pastures are unimproved and require renovation and brush control.

In some pastures and meadows, overgrazing has resulted in weedy, low-quality forage and a sparse, short plant cover, which has increased the hazard of erosion. The soils in these overgrazed areas commonly are acid and have a low supply of phosphorus and potassium. In time, good management can restore the areas to a much higher level of productivity.

Successful establishment of forage crops requires the selection of quality species and varieties for seeding. The species and varieties should be those that are suited to the climate and the soils. Reseeding requires proper seedbed preparation, proper seeding methods, timely seeding, and applications of lime and fertilizer. Forage renovation requires that the existing grasses and weeds be killed or suppressed before the desired species are reseeded. The object is to kill the existing sod and leave it on or near the surface as a dead mulch, which helps to control erosion. Nearly level pastures can be plowed. The vegetation on gently sloping and strongly sloping soils should be killed or suppressed. The pasture should be tilled and seeded on the contour.

The no-till seeding method can be effective on most of the soils in the county, except for those in which drainage is restricted. Where this method is used, vegetation should be suppressed or killed by grazing and by applying herbicides.

April or August is usually the best time to seed forage species. Small grain can be seeded with the forage species. In many areas, however, it competes with the forage species for light, moisture, and nutrients and thus reduces forage production.

Seeding mixtures should be based on the kind of soil and the desired system of pasture management. Mixtures of grasses and legumes have a higher nutrient value than grasses alone. Also, the legumes provide nitrogen, which improves the growth of grasses. Alfalfa and red clover should be seeded on well drained soils. Ladino clover and alsike clover are better suited to the wetter soils. Birdsfoot trefoil, bromegrass, lespedeza, warm-season grasses, and vetches are generally not grown as forage species in Brown County, but they are adapted to the county and could be used in a forage management system.

Applications of lime and fertilizer that are based on the results of soil tests help to ensure good productivity and lengthen the life of forage stands. Weed control helps to ensure continued high production. The weeds can be controlled by mowing, clipping, and spraying. They should be mowed before they go to seed. Control of insects, such as alfalfa weevil and potato leafhopper, may be necessary. Harvesting hay and silage at the proper stage of maturity helps to obtain the maximum quality of feed.

At the end of each description under the heading "Detailed Soil Map Units," the soils in the county are assigned a pasture and hayland suitability group symbol. Soils that are assigned the same symbol require the same general management and have about the same potential productivity. The pasture and hayland suitability groups are based on soil characteristics and limitations.

Group A soils have few limitations that affect the management and growth of climatically adapted plants.

Group A-1 soils are moderately deep or deep and are moderately well drained or well drained. The texture of the surface layer includes silt loam, silty clay, and clay loam. Available water capacity is low to high. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH in the subsoil shortens the life of some deep-rooted legumes. Slopes range from 2 to 15 percent.

Group A-2 soils are deep and are well drained or moderately well drained. The surface layer is silty clay loam, silty clay, or silt loam. Available water capacity is low or moderate. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH in the subsoil shortens the life of some deep-rooted legumes. Slopes range from 15 to 25 percent. They may interfere with the mechanical application of lime and fertilizer and with clipping, mowing, and spraying for weed control. They increase the risk of erosion if the pasture or hayland is overgrazed or is cultivated before it is reseeded. These soils are suited to no-till reseeding and interseeding.

Group A-3 soils are deep and are moderately well drained or well drained. The texture of the surface layer includes silty clay and silt loam. Available water capacity is low or moderate. Slopes range from 25 to 40 percent. These soils are generally not suitable as pasture or hayland because of the slope.

Group A-5 soils are deep and well drained. They are on flood plains and are frequently flooded or occasionally flooded. Grazing is restricted during periods of stream overflow, and the deposition of sediments by floodwater lowers the quality of the forage. The surface layer is silt loam. Available water capacity is very high. Slopes are 0 to 2 percent.

Group A-6 soils are deep and are well drained or moderately well drained. They are subject to frost action, which can damage a legume stand. Mixing fibrous-rooted grasses with the legumes and applying

proper grazing management minimize the damage caused by frost action. The surface layer is silt loam. Available water capacity is very high or high. Slopes range from 2 to 12 percent.

Group C soils are wet because of a seasonal high water table.

Group C-1 soils are deep and somewhat poorly drained. The surface layer is silt loam. Available water capacity is high. Frost action can damage legumes. Including fibrous-rooted grasses in the seeding mixture and applying proper grazing management minimize the damage caused by frost action. The seasonal high water table restricts the rooting depth of forage plants. Shallow-rooted species grow best. Subsurface drains are used to lower the water table. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH in the subsoil shortens the life of some deep-rooted legumes. Slopes range from 0 to 4 percent.

Group C-2 soils are deep and are somewhat poorly drained or poorly drained. The surface layer is silty clay loam or silt loam. Available water capacity is moderate. The seasonal high water table restricts the rooting depth of deep-rooted forage plants. In some of the soils, a fragipan also restricts the rooting depth. Shallow-rooted species grow best. The growth of forage species that have a taproot is restricted because of the limited root zone. Subsurface drains are used to lower the water table. The effectiveness of these drains generally is limited by restricted permeability in the subsoil or the landscape position of the soils. Slopes range from 0 to 12 percent.

Group C-3 soils are deep and somewhat poorly drained. They are on flood plains and are frequently flooded. Grazing is restricted during periods of stream overflow, and the deposition of sediments by floodwater lowers the quality of the forage. The surface layer is silt loam. Available water capacity is high. Frost action can damage legumes. Including grasses in the seeding mixture and applying proper grazing management minimize the damage caused by frost action. The seasonal high water table restricts the rooting depth of forage plants. Shallow-rooted species grow best. Subsurface drains are used to lower the water table. The effectiveness of these drains is limited by the landscape position of the soils.

Group F soils have a root zone of 20 to 40 inches. The growth of forage species that have a taproot is restricted because of the moderately deep root zone.

Group F-1 soils are moderately deep and well drained. The surface layer is silt loam. Available water capacity is low. These soils are droughty. They are suited to warm-season grasses, such as switchgrass, big bluestem, indiangrass, and Caucasian bluestem. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH in the subsoil shortens the life of some deep-rooted legumes. Slopes range from 8 to 25 percent.

Group F-2 soils are moderately deep, steep, and well drained. The surface layer is flaggy silt loam. Available water capacity is low. Slopes range from 25 to 40 percent. These soils are generally not suitable as pasture or hayland.

Group F-3 soils are deep and are well drained or moderately well drained. They have a fragipan. The growth of forage species that have a taproot is restricted because of a limited root zone. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH in the subsoil shortens the life of some deep-rooted legumes. The surface layer is silt loam. Available water capacity is low in the root zone. Slopes range from 0 to 12 percent.

Group F-7 soils have a high content of clay in the subsoil and a seasonal high water table that restricts the rooting depth. They are poorly drained. The surface layer is silt loam. Available water capacity is high. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH in the subsoil shortens the life of some deep-rooted legumes.

Group H soils are generally not suitable as pasture or hayland. Group H-1 soils have slopes of more than 40 percent.

### Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable

soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

### Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(11)*. Only class and subclass are used in this survey.

*Capability classes*, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

*Capability subclasses* are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

## Woodland Management and Productivity

R.L. Hendershot, area agronomist, Soil Conservation Service, helped prepare this section.

Woodland is an important land use in Brown County. About 66,590 acres in the county, or more than 21 percent of the total acreage, is woodland *(15)*. About 49,445 acres, or nearly 75 percent of the woodland, is in land capability class III, IV, VI, or VII. The most extensive areas of woodland are in the southern part of the county. The wooded acreage consists mainly of privately owned stands and farm woodlots.

The woodland is mainly areas of mixed hardwoods. The major forest types are elm-ash and beech-maple in the northern part of the county and mixed mesophytic beech-maple and oak-hickory in the southern part. Of the total acreage of woodland, about 50 percent is areas of oaks, 17 percent is areas of elm-ash, and 33 percent is areas of northern hardwoods *(6)*.

The scattered woodlots in the northern half of the county are typically small. They are on short slopes along narrow stream valleys, on narrow flood plains, and in undrained areas on uplands. In the southern half

of the county, most of the wooded areas are on moderately steep to very steep hillsides. Some, however, are on sloping ridgetops. Christmas trees are grown on a few scattered farms throughout the county.

Many woodlots have been poorly managed. Heavy selective cutting without planning for future timber crops has resulted in stands of overly mature and cull trees. High grading has continually removed the best trees and left culls and trees of low value to occupy valuable growing space. In many areas grazing livestock have destroyed the leaf litter and desirable young trees, damaged roots, and compacted the soil. In some areas forest fires have damaged large trees, interfered with natural seeding, and destroyed the leaf litter.

In time, good management can restore poorly managed woodland to a high level of production. Measures that protect the woodland from grazing and fire, timber stand improvement, prescribed marking, and appropriate harvesting techniques increase production. Winter stand improvement practices, including culling the diseased and less desirable trees and cutting or spraying grapevines, increase the growth rate of favored species and shorten the rotation time considerably. In areas of soils that have a high water table, the trees should be harvested during the drier periods or when the ground is frozen.

The survival of seedlings is affected by the vigor of the planting stock, the adequacy of site preparation, applications of fertilizer, and control of competing weeds. The species selected for planting should be those that have high vigor and are suited to the soil. The necessary cultural practices can increase the growth rate after the seedlings are planted. Competing vegetation can be controlled by disking, mowing, spraying, mulching, girdling, and cutting. Under intensive management, the most valuable species can be reestablished on soils that are well suited to hardwoods. Pine can be successfully planted on soils that are poorly suited to hardwoods.

Woodland productivity varies widely from soil to soil. The soil factors influencing tree growth include internal drainage, reaction, texture, depth, natural fertility, available water capacity, slope, aspect, and position on the landscape. Other important factors include radiation, precipitation, and the movement and composition of the air *(12)*.

Aspect is the compass direction in which a slope faces. North aspects have an azimuth of 355 to 75 degrees, and south aspects have one of 96 to 354 degrees. Trees grow better on north and east aspects than on south and west aspects because of less exposure to the prevailing wind and the sun and because of more soil moisture. South and west aspects are less well suited to trees because of a higher soil temperature, a higher evaporation rate, and earlier snowmelt *(4)*.

The position of the soil on long side slopes influences the amount of moisture available for tree growth. The lower positions generally receive more moisture than the higher positions because of downslope runoff and seepage.

Slope affects the hazard of erosion and the use of equipment. As the gradient increases, the rate of runoff and the hazard of erosion also increase. Erosion reduces the total amount of soil available for water storage. Severe erosion removes the protective surface layer and commonly exposes a less porous subsoil, thus increasing the runoff rate and lowering the rate of water infiltration. Both tree growth and natural reseeding are adversely affected. The hazard of erosion can be reduced by building logging roads and skid trails on the contour and by establishing water bars wherever needed.

Additional information about woodland management can be obtained from the local offices of the Soil Conservation Service and the Ohio Department of Natural Resources, Division of Forestry.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *L*, low strength. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and L.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

*Erosion hazard* is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes,

and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

*Equipment limitation* reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

*Seedling mortality* refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

*Windthrow hazard* is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

*Trees to plant* are those that are suitable for commercial wood production.

## Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs

can be obtained from a commercial nursery or from local offices of the Soil Conservation Service; the Ohio Department of Natural Resources, Division of Forestry; or the Cooperative Extension Service.

## Recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

*Camp areas* require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

*Picnic areas* are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

*Playgrounds* require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

*Paths and trails* for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

*Golf fairways* are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

## Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor *(1)*. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in

most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

*Grain and seed crops* are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, and soybeans.

*Grasses and legumes* are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, bromegrass, clover, and alfalfa.

*Wild herbaceous plants* are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are foxtail, goldenrod, smartweed, and ragweed.

*Hardwood trees* and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, beech, maple, apple, hawthorn, dogwood, hickory, blackberry, and black walnut. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are shrub honeysuckle, autumn olive, and crabapple.

*Coniferous plants* furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

*Wetland plants* are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, duckweed, reed canarygrass, rushes, sedges, and reeds.

*Shallow water areas* have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

*Habitat for openland wildlife* consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

*Habitat for woodland wildlife* consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and white-tailed deer.

*Habitat for wetland wildlife* consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, muskrat, mink, and beaver.

## Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

*Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet.*

*Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.*

*The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.*

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreation uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the "Glossary."

## Urban Development and Landslides

Two types of landslides occur in Brown County—rotational slumps and rapid earth flows. These slides can occur in areas where soil material of varying depth overlies interbedded shale and limestone bedrock. The bedrock is relatively impermeable to water. As a result, rain or water from other sources infiltrates the soil, percolates to the bedrock, and then flows along the soil-bedrock contact. The water increases the hydrostatic pressure within the soil. This increased pressure lowers the bearing strength of the soil. Eventually, when the soil becomes saturated, the weight of the soil mass is greater than the forces holding it in place and a slide occurs.

Geologists, engineers, and soil scientists have found five factors common to the landslides that have occurred in Brown County. These are the Kope Formation, a source of water, poor soil drainage, slopes of more than 15 percent, and a poor plant cover.

The Kope Formation is an Ordovician-aged gray shale interbedded with thin layers of limestone. The shale makes up more than 75 percent of the bedrock. The formation is widely distributed in the southern part of the county. Upon exposure, the shale weathers easily, slaking to a highly plastic, clayey mass that is very unstable.

Without a source of water, landslides cannot occur in Brown County. The source of water may be natural, as from snowmelt or spring rains, or it may be an artificial source, such as a broken water main or storm runoff collected in a blocked road ditch.

Poor soil drainage is a requirement for landslides. Before the slide can occur, the soil must retain water until it approaches the saturation point. If the water is drained away through surface or subsurface drains, the slide should not occur.

In the past the slides have occurred on slopes of more than 15 percent. About 22 percent of the land in Brown County has slopes of more than 15 percent.

A poor plant cover has been noted at many slides. Plant roots, especially tree roots, help to anchor a soil in place. Many slides, however, have occurred on forested slopes. A good plant cover alone cannot prevent a landslide.

Some landslides occur naturally, but nearly every landslide that has occurred in Brown County has been caused by human activities. Certain measures can help to prevent a construction failure caused by a landslide. Buildings should not be constructed on soils that have slopes of more than 15 percent, especially on the steeper Pate soils. Where construction on these slopes is mandatory, however, the surface should be disturbed as little as possible, even if the landscape appears to be stable. Water should be removed from the site so that it cannot saturate the soil. Fill should not be placed on steep slopes, and buildings should never be constructed on fills that are near steep slopes. The closer to the slope, the greater the chance for a slide.

The toe or bottom part of a slope should not be disturbed because it helps to stabilize the entire slope. Seeding the slope to grass or other vegetation as soon as possible after disturbance helps to control erosion.

**Building Site Development**

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

*Shallow excavations* are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

*Dwellings* and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

*Local roads and streets* have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

*Lawns and landscaping* require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and toxic substances affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

**Sanitary Facilities**

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

*Septic tank absorption fields* are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that

part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

*Sewage lagoons* are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

*Sanitary landfills* are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

*Daily cover for landfill* is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

## Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

*Roadfill* is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

*Sand* and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

*Topsoil* is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

**Water Management**

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so

difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

*Pond reservoir areas* hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

*Embankments, dikes, and levees* are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

*Aquifer-fed excavated ponds* are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

*Drainage* is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. Availability of drainage outlets is not considered in the ratings.

*Terraces and diversions* are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

*Grassed waterways* are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

# Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

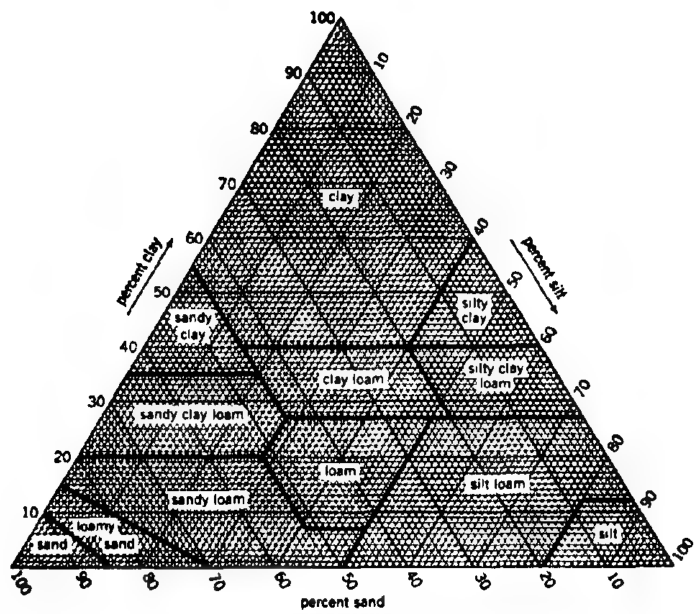



**Figure 11.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.**

## Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

*Depth* to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

*Texture* is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 11). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

*Classification* of the soils is determined according to the Unified soil classification system *(3)* and the system adopted by the American Association of State Highway and Transportation Officials *(2)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to

those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

*Rock fragments* larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

*Percentage (of soil particles) passing designated sieves* is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

*Liquid limit* and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

## Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

*Clay* as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

*Moist bulk density* is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

*Permeability* refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

*Available water capacity* refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

*Soil reaction* is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

*Shrink-swell potential* is the potential for volume

change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

*Erosion factor K* indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

*Erosion factor T* is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

*Wind erodibility groups* are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to reestablish after cultivation.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

*Organic matter* is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

## Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

*Hydrologic soil groups* are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

*Flooding*, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

*High water table* (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

*Depth to bedrock* is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

*Potential frost action* is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

*Risk of corrosion* pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be

needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

## Physical and Chemical Analyses of Selected Soils

Samples of many of the soils in Brown County were analyzed by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The physical and chemical data obtained from most of the samples include particle-size distribution, reaction, organic matter content, calcium carbonate equivalent, and extractable cations. These data were used in classifying the soils and in evaluating their behavior under various land uses.

Four of the pedons selected as representative of their respective series were sampled for analysis. They are described in the section "Soil Series and Their Morphology." These series and their laboratory identification numbers are Avonburg series (BN-23), Clermont series (BN-19), Lowell series (BN-25), and Pate series (BN-24).

In addition to the data from Brown County, laboratory data are available from nearby counties that have many of the same soils. All the data are on file at the Department of Agronomy, Ohio State University, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Soil and Water Conservation; and the Soil Conservation Service, State Office, Columbus, Ohio.

## Engineering Index Test Data

Two of the soils in Brown County were analyzed for engineering properties by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soil and Foundation Section. These series and their laboratory identification numbers are Lowell series (BN-25) and Pate series (BN-24).

In addition to the data from Brown County, engineering test data are available from nearby counties that have many of the same soils. All the data are on file at the Department of Agronomy, Ohio State University; the Ohio Department of Natural Resources, Division of Soil and Water Conservation; and the Soil Conservation Service, State Office, Columbus, Ohio.

# Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(13)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aqualf (*Aqu*, meaning water, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Ochraqualfs (*Ochr*, meaning pale colored surface layer, plus *aqualf*, the suborder of the Alfisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Ochraqualfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, mesic Typic Ochraqualfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

## Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(10)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(13)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

### Algiers Series

The Algiers series consists of deep, somewhat poorly drained soils on flood plains. These soils formed in loamy alluvium over a dark buried soil. Permeability is

moderate. Slopes are 0 to 2 percent.

Algiers soils are adjacent to Genesee and Shoals soils on flood plains. Genesee and Shoals soils are not underlain by a dark buried soil.

Typical pedon of Algiers silt loam, frequently flooded, about 3 miles east of Mount Orab, in Washington Township; 315 feet east of Flat Run, along the Highland County line, then 15 feet south of the Highland County line:

Ap—0 to 5 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine and medium granular structure; friable; many fine roots; few small coarse fragments; neutral; abrupt smooth boundary.

C1—5 to 11 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; common fine roots; few small coarse fragments; mildly alkaline; clear smooth boundary.

C2—11 to 20 inches; dark grayish brown (10YR 4/2) silt loam; few fine distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; friable; common fine roots; mildly alkaline; abrupt smooth boundary.

2Ab—20 to 30 inches; black (10YR 2/1) loam; weak medium subangular blocky structure; friable; few fine roots; few fine pebbles; mildly alkaline; clear smooth boundary.

2Bgb1—30 to 37 inches; dark grayish brown (2.5Y 4/2) loam; common fine distinct yellowish brown (10YR 5/4 and 5/6) mottles; moderate medium subangular blocky structure; friable; many faint grayish brown (2.5Y 4/2) coatings on faces of peds; common distinct black (10YR 2/1) organic coatings on faces of peds; few small coarse fragments; mildly alkaline; clear smooth boundary.

2Bgb2—37 to 49 inches; grayish brown (2.5Y 5/2) loam; many fine distinct yellowish brown (10YR 5/4) and common medium distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; friable; many grayish brown (2.5Y 5/2) coatings on faces of peds; common distinct very dark gray (10YR 3/1) and dark gray (10YR 4/1) organic coatings on faces of peds; few dark soft accumulations of iron and manganese oxide; few small coarse fragments; mildly alkaline; clear wavy boundary.

2Cg—49 to 63 inches; grayish brown (2.5Y 5/2) sandy loam; many coarse prominent yellowish brown (10YR 5/8) mottles; massive; very friable; few small coarse fragments; few dark soft accumulations of iron and manganese oxide; mildly alkaline.

The recent alluvium is 15 to 36 inches thick. The Ap horizon has chroma of 2 or 3. It typically is silt loam, but in some pedons it is loam. The C horizon has hue of 2.5Y or 10YR and value of 4 or 5. It commonly is silt loam or loam, but it has subhorizons of sandy loam in some pedons. The 2Ab horizon has value of 2 or 3 and chroma of 1 or 2. It is loam, clay loam, silt loam, or silty clay loam. The 2Bgb horizon has value of 4 or 5 and chroma of 1 or 2. It is loam, silty clay loam, or clay loam. The 2Cg horizon is silty clay loam, clay loam, or sandy loam.

## Atlas Series

The Atlas series consists of deep, somewhat poorly drained soils along shallow drainageways and on side slopes along small drainageways on the Illinoian till plain. These soils formed in glacial till and in places in a thin mantle of loess. Permeability is very slow. Slopes range from 2 to 12 percent.

Atlas soils are adjacent to Avonburg, Clermont, and Rossmoyne soils. The adjacent soils contain more silt and less clay in the upper part of the solum than the Atlas soils. Avonburg soils commonly are in nearly level areas but in some areas are on gentle slopes along drainageways. Clermont soils are on broad flats. Rossmoyne soils are in sloping areas along drainageways.

Typical pedon of Atlas silty clay loam, 6 to 12 percent slopes, eroded, about 2.5 miles northwest of Fincastle, in Eagle Township; 620 feet west of Stivers Road, along the Highland County line, then 10 feet south of the Highland County line:

Ap—0 to 6 inches; brown (10YR 5/3) silty clay loam, pale brown (10YR 6/3) dry; moderate medium granular and weak very fine subangular blocky structure; firm; many fine roots; mixed by tillage with about 35 percent yellowish brown (10YR 5/4) subsoil material; few small coarse fragments; strongly acid; abrupt smooth boundary.

Bt1—6 to 14 inches; dark yellowish brown (10YR 4/4) silty clay loam; grayish brown (2.5Y 5/2) faces of peds; common fine distinct dark grayish brown (2.5Y 4/2) mottles; moderate medium angular and subangular blocky structure; firm; common fine roots; common distinct grayish brown (10YR 5/2) clay films on faces of peds; few small coarse fragments; very strongly acid; gradual smooth boundary.

Bt2—14 to 20 inches; dark yellowish brown (10YR 4/4) silty clay; grayish brown (2.5Y 5/2) faces of peds; common fine distinct dark grayish brown (2.5Y 4/2) and grayish brown (10YR 5/2) mottles; moderate coarse angular blocky structure; very firm; common

fine roots; common distinct clay films on faces of peds; few small coarse fragments; very strongly acid; gradual smooth boundary.

Btg1—20 to 28 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine prominent strong brown (7.5YR 5/6) mottles; weak and moderate coarse angular blocky structure; firm; few fine roots; many faint grayish brown (2.5Y 5/2) clay films on faces of peds; few small coarse fragments; many dark concretions and soft accumulations of iron and manganese oxide in the middle part of the horizon; strongly acid; clear wavy boundary.

Btg2—28 to 51 inches; dark gray (10YR 4/1) silty clay loam; many medium distinct brown (10YR 4/3) mottles; weak coarse prismatic structure parting to weak and moderate coarse angular blocky; firm; few fine roots to a depth of about 34 inches; common faint dark gray (10YR 4/1) and grayish brown (2.5Y 5/2) clay films on faces of peds; few small coarse fragments; medium acid; clear wavy boundary.

B't1—51 to 58 inches; strong brown (7.5YR 5/6) silty clay loam; dark gray (10YR 4/1) faces of peds; common medium and coarse prominent dark gray (10YR 4/1) mottles; weak coarse subangular blocky structure; firm; common faint dark gray (10YR 4/1) clay films on faces of peds; about 2 percent small coarse fragments; neutral; gradual smooth boundary.

B't2—58 to 72 inches; yellowish brown (10YR 5/6) clay loam; light gray (10YR 6/1) faces of peds; many coarse prominent gray (10YR 5/1) mottles; weak coarse subangular blocky structure; firm; common faint gray (10YR 6/1) clay films on faces of peds; about 2 percent small coarse fragments; few fine white (10YR 8/2) soft accumulations of calcium carbonate; strong effervescence in soft accumulations; mildly alkaline in the matrix; gradual smooth boundary.

BC—72 to 80 inches; yellowish brown (10YR 5/4) clay loam; many coarse prominent gray (10YR 5/1) mottles; weak coarse subangular blocky structure; firm; few faint light gray (10YR 6/1) clay films on faces of peds; about 2 percent small coarse fragments; common fine and medium white (10YR 8/1) soft accumulations of calcium carbonate; strong effervescence; mildly alkaline.

The solum is 60 to more than 80 inches thick. Some pedons have a silty mantle as much as 20 inches thick.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The Bt and B't horizons have value of 4 or 5 and chroma of 3 to 6. They are silty clay loam, silty clay, clay, or clay loam. The Btg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It has textures similar to those of the Bt and B't horizons.

## Avonburg Series

The Avonburg series consists of deep, somewhat poorly drained soils on broad flats, slight rises, and knolls and along shallow drainageways on the Illinoian till plain. These soils formed in loess and in the underlying glacial till. Permeability is moderate in the upper part of the profile and very slow in the lower part. Slopes range from 0 to 6 percent.

Avonburg soils are commonly adjacent to Atlas, Blanchester, Clermont, and Rossmoyne soils. Atlas soils contain more clay than the Avonburg soils. They are in the more sloping areas. Blanchester and Clermont soils are wetter than the Avonburg soils. Also, they are grayer in the subsoil. Blanchester soils are in slight depressions. Clermont soils are on broad flats. Rossmoyne soils are moderately well drained and are on knolls and at the head of drainageways. They are less gray in the subsoil than the Avonburg soils.

Typical pedon of Avonburg silt loam, 0 to 2 percent slopes, about 1 mile southeast of Fayetteville, in Perry Township; about 4,850 feet east of the intersection of U.S. Highway 68 and Campbell Road, along Campbell Road, then 500 feet north of Campbell Road:

Ap—0 to 8 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak fine granular structure; very friable; common fine roots; neutral; abrupt smooth boundary.

BE—8 to 12 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct light brownish gray (10YR 6/2) and common medium faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure parting to weak thin platy; friable; few fine roots; strongly acid; clear smooth boundary.

Bt—12 to 17 inches; light yellowish brown (10YR 6/4) silt loam; many distinct light brownish gray (10YR 6/2) coatings on faces of peds; common fine distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; few fine roots; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

E/B—17 to 21 inches; light brownish gray (10YR 6/2) silt loam (E); few medium faint yellowish brown (10YR 5/8) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; many semirounded bodies of pale brown (10YR 6/3) silty clay loam (Bt); few fine roots; few faint grayish brown (10YR 5/2) clay films on

faces of peds in the Bt part; very strongly acid; clear smooth boundary.

B/E—21 to 29 inches; yellowish brown (10YR 5/6) silty clay loam; grayish brown (10YR 5/2) faces of peds; common medium faint brown (10YR 6/3) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few fine roots; many distinct grayish brown (10YR 5/2) clay films on vertical faces of peds in the Bt part, common on horizontal faces; many prominent light brownish gray (10YR 6/2) silt coatings on vertical faces of prisms; few pebbles; very strongly acid; gradual smooth boundary.

2Btx1—29 to 38 inches; yellowish brown (10YR 5/4) clay loam and loam; common medium faint yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to weak thick platy; very firm and brittle in about 65 percent of the horizon; many distinct grayish brown (10YR 5/2) clay films on faces of peds, common on horizontal faces; many dark soft accumulations and concretions of iron and manganese oxide; about 5 percent coarse fragments; very strongly acid; clear smooth boundary.

2Btx2—38 to 45 inches; dark yellowish brown (10YR 4/4) loam; common medium distinct yellowish brown (10YR 5/6) and common fine distinct light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm and very firm and brittle in about 40 percent of the horizon; many prominent gray (10YR 5/1) clay films on vertical faces of prisms and common distinct gray (10YR 5/1) clay films on horizontal faces of peds; many dark concretions and soft accumulations of iron and manganese oxide; about 5 percent coarse fragments; medium acid; gradual smooth boundary.

2Bt—45 to 80 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) clay loam; few medium distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate medium angular and subangular blocky; firm; many prominent gray (10YR 5/1) clay films on vertical faces of peds; common dark soft accumulations of iron and manganese oxide; about 5 percent coarse fragments; slightly acid in the upper part and neutral in the lower part.

The content of coarse fragments ranges from 1 to 10 percent in the 2Bt horizon and from 2 to 15 percent in the substratum. The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The Bt horizon has value of 5 or 6 and chroma of 3 to 6. It is silt loam or silty clay loam. The 2Btx and 2Bt horizons have value of 4 to 6 and chroma of 2 to 8. They generally are clay loam or loam, but in some pedons the 2Btx horizon is silt loam or silty clay loam. Some pedons have a 2C horizon. This horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6. It is loam or clay loam.

The gently sloping Avonburg soils are taxadjuncts because they have a high reaction in the lower part and have more sand in the fragipan than is definitive for the series. These differences, however, do not affect the use and management of the soils.

## Blanchester Series

The Blanchester series consists of deep, poorly drained soils in slight depressions on the Illinoian till plain. These soils formed in loess and in the underlying glacial till. Permeability is slow in the upper part of the profile and slow or very slow in the lower part. Slopes are 0 to 2 percent.

Blanchester soils are similar to Clermont soils and are commonly adjacent to Avonburg and Clermont soils. Avonburg soils are somewhat poorly drained and are on slight rises. They are less gray in the subsoil than the Blanchester soils. Clermont soils have a surface layer that is lighter colored than that of the Blanchester soils. They are on broad flats.

Typical pedon of Blanchester silt loam, about 1.6 miles northwest of Mt. Orab, in Sterling Township; 2,500 feet south of the intersection of State Route 32 and Brooks-Malott Road, then 650 feet west:

Ap—0 to 8 inches; dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium granular structure; friable; common roots; slightly acid; abrupt smooth boundary.

Btg1—8 to 16 inches; dark gray (10YR 4/1) silty clay loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; firm; few distinct dark gray (N 4/0) clay films on faces of peds; medium acid; clear smooth boundary.

Btg2—16 to 24 inches; dark gray (10YR 4/1) silty clay loam; many medium distinct grayish brown (10YR 5/2) and common coarse prominent yellowish brown (10YR 5/6) mottles; moderate medium and coarse angular blocky structure; firm; few distinct dark gray (N 4/0) clay films on faces of peds; medium acid; diffuse smooth boundary.

Btg3—24 to 40 inches; gray (10YR 5/1) silty clay loam; many medium and coarse prominent yellowish brown (10YR 5/6) mottles; moderate coarse angular blocky structure; firm; few distinct dark gray (N 4/0) clay films on faces of peds and in old root channels;

medium acid; clear wavy boundary.

2Btg4—40 to 60 inches; grayish brown (10YR 5/2) silty clay loam; many medium and coarse prominent strong brown (7.5YR 5/6) mottles; moderate coarse subangular blocky structure; firm; common distinct dark gray (N 4/0) clay films on faces of peds and in old root channels; about 2 percent coarse fragments; slightly acid; gradual wavy boundary.

2Btg5—60 to 72 inches; gray (10YR 5/1) clay loam; many coarse prominent strong brown (7.5YR 5/6) mottles; moderate coarse subangular blocky structure; firm; common distinct gray (N 5/0) clay films on faces of peds; about 3 percent coarse fragments; neutral; gradual wavy boundary.

2BC—72 to 80 inches; strong brown (7.5YR 5/6) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; about 5 percent coarse fragments; neutral; gradual wavy boundary.

2C—80 to 90 inches; yellowish brown (10YR 5/4) clay loam; many medium distinct gray (10YR 5/1) mottles; massive; firm; about 5 percent coarse fragments; calcareous below a depth of 85 inches; slight effervescence; mildly alkaline.

The solum ranges from 50 to 80 inches in thickness. The thickness of the silty mantle ranges from 18 to 40 inches.

The Ap or A horizon has value of 3 or 4 and chroma of 1 or 2. It typically is silt loam, but in some pedons it is silty clay loam. The Btg and 2Btg horizons have hue of 10YR or 2.5Y or are neutral in hue. They have value of 4 to 6 and chroma of 0 to 2. They have common or many high-chroma mottles. They are silty clay loam, clay loam, or clay.

## Bonnell Series

The Bonnell series consists of deep, well drained, slowly permeable soils on side slopes bordering stream valleys on the Illinoian till plain. These soils formed in glacial till and in places in a thin mantle of loess. Slopes range from 6 to 60 percent.

Bonnell soils are commonly adjacent to Eden and Rossmoyne soils and are similar to Jessup soils. Eden soils have shale and limestone bedrock within 40 inches of the surface. They are on hillsides and narrow shoulder slopes. Jessup soils formed in loess, glacial till, and the underlying clayey material weathered from shale and limestone. They are on side slopes along drainageways and at the head of drainageways. Rossmoyne soils are wetter than the Bonnell soils. They have gray mottles in the subsoil and have a fragipan. They are on knolls, at the head of drainageways, and on side slopes along drainageways.

Typical pedon of Bonnell silt loam, 15 to 25 percent slopes, eroded, in Georgetown, in Pleasant Township; 738 feet west of the intersection of Main Street and Free Soil Road, then 690 feet north:

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate coarse granular structure; friable; common fine roots; common medium distinct dark yellowish brown (10YR 6/4) pieces of B material; about 2 percent pebbles; neutral; abrupt smooth boundary.

Bt1—6 to 16 inches; dark yellowish brown (10YR 4/6) clay; moderate fine subangular blocky structure; firm; common prominent dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine roots; common distinct brown (10YR 4/3) root channel fillings; about 3 percent pebbles; medium acid; gradual wavy boundary.

Bt2—16 to 24 inches; dark yellowish brown (10YR 4/6) clay loam; few fine distinct brown (10YR 5/3) mottles; moderate fine and medium subangular blocky structure; firm; few fine roots; common prominent brown (10YR 5/3) and dark yellowish brown (10YR 4/4) clay films on faces of peds; common fine distinct black (10YR 2/1) stains of iron and manganese oxide; about 5 percent pebbles; medium acid; gradual wavy boundary.

Bt3—24 to 30 inches; dark yellowish brown (10YR 4/4) clay loam; few fine distinct brown (10YR 5/3) mottles; moderate coarse subangular blocky structure; firm; few fine roots; few distinct brown (10YR 4/3) clay films on faces of peds; common fine distinct black (10YR 2/1) stains of iron and manganese oxide; about 5 percent pebbles; neutral; clear wavy boundary.

BC—30 to 43 inches; dark yellowish brown (10YR 4/4) clay loam; common medium distinct brown (10YR 5/3) mottles; weak medium subangular blocky structure; firm; few fine roots; medium very patchy dark yellowish brown (10YR 4/4) clay films; about 3 percent limestone ghosts; about 10 percent coarse fragments; strong effervescence in ped interiors but no effervescence on clay films; mildly alkaline; gradual wavy boundary.

C—43 to 60 inches; yellowish brown (10YR 5/4) loam; massive; very firm; light brownish gray (10YR 6/2) and light gray (10YR 7/2) lime concentrations on horizontal cleavage planes; about 12 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates are dominantly 24 to 48 inches but range to

10 inches in severely eroded pedons. The loess cap is less than 10 inches thick. The content of coarse fragments ranges from 1 to 10 percent in the solum and from 5 to 15 percent in the underlying glacial till.

The A horizon has value and chroma of 2 to 4. It is silt loam, clay loam, or silty clay loam. The Bt horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is clay loam, silty clay loam, or clay. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is loam or clay loam.

## Chili Series

The Chili series consists of deep, well drained soils that formed in stratified outwash deposits. These soils are along the valley slopes formed when streams cut through the terraces along the Ohio River. Permeability is moderately rapid in the subsoil and rapid in the underlying material. Slopes range from 35 to 70 percent.

Chili soils are adjacent to Elkinsville and Pate soils. Elkinsville soils formed in silty and loamy material on gently sloping and sloping terraces. Pate soils formed in clayey colluvium in areas upslope from the Chili soils. They are underlain by interbedded shale and limestone.

Typical pedon of Chili loam, 35 to 70 percent slopes, in Aberdeen, in Huntington Township; 577 feet west of the intersection of State Route 41 and U.S. Highway 52, then 2,224 feet north:

A—0 to 6 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many fine and medium roots; neutral; abrupt wavy boundary.

Bt1—6 to 17 inches; brown (10YR 4/3) loam; weak coarse subangular blocky structure; friable; few fine and medium roots; few faint brown (10YR 4/3) clay films on faces of peds; common faint dark brown (10YR 3/3) organic coatings on faces of peds; about 3 percent gravel; strongly acid; gradual wavy boundary.

Bt2—17 to 26 inches; yellowish brown (10YR 5/4) gravelly sandy loam; weak coarse subangular blocky structure; very friable; few medium roots; many faint clay films on surfaces of pebbles; about 30 percent gravel; slightly acid; clear wavy boundary.

Bt3—26 to 39 inches; dark yellowish brown (10YR 4/4) sandy loam; weak coarse subangular blocky structure; very friable; some clay bridges between sand grains; about 3 percent gravel; neutral; clear wavy boundary.

Bt4—39 to 46 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam; weak coarse subangular blocky structure; very friable; few medium roots; many faint clay films on surfaces of pebbles; about 30 percent gravel; clear wavy boundary.

C—46 to 65 inches; yellowish brown (10YR 5/4) loamy sand; single grained; loose; about 10 percent gravel; mildly alkaline.

The solum ranges from 40 to 65 inches in thickness. The content of gravel varies in most pedons because of stratification. It ranges from 0 to 10 percent within a depth of 20 inches and from 10 to 30 percent in the part of the B horizon below a depth of 20 inches and in the C horizon.

The A horizon has chroma of 2 to 4. It typically is loam but is sandy loam, gravelly sandy loam, or gravelly loam in some pedons. The Bt horizon has chroma of 3 to 6. It is dominantly loam, sandy loam, sandy clay loam, or the gravelly analogs of those textures, but it has thin strata of loamy sand in some pedons. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is uniform or stratified and is loamy sand or gravelly loamy sand.

## Cincinnati Series

The Cincinnati series consists of deep, well drained soils on ridgetops, at the head of drainageways, and along drainageways on the Illinoian till plain. These soils formed in loess and in the underlying glacial till. They have a thin fragipan. Permeability is moderate in the upper part of the profile and slow or moderately slow in the fragipan. Slopes range from 6 to 12 percent.

Cincinnati soils are similar to Rossmoyne soils and are commonly adjacent to Avonburg, Bonnell, Clermont, and Rossmoyne soils. Avonburg and Clermont soils are grayer in the subsoil than the Cincinnati soils. Bonnell soils formed mainly in till and do not have a fragipan. Rossmoyne soils have a mottled subsoil. Avonburg soils are in nearly level areas or on gentle slopes along drainageways. Bonnell soils are on moderately steep to very steep valley walls or along drainageways. Clermont soils are on broad flats. Rossmoyne soils are in gently sloping or sloping areas along drainageways.

Typical pedon of Cincinnati silt loam, 6 to 12 percent slopes, eroded, about 3 miles northwest of Higginsport, in Lewis Township; 2,650 feet east of the intersection of Buckeye Road and Shinkle Road, then 90 feet south of Shinkle Road:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; mixed by tillage with about 25 percent yellowish brown (10YR 5/6) subsoil material; weak fine granular structure; friable; many fine roots; strongly acid; abrupt wavy boundary.

Bt1—8 to 11 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common fine roots; few distinct brown (7.5YR 4/4) clay films on faces of peds; common faint yellowish brown (10YR 4/4) silt coatings on faces of peds, distinct and very pale brown (10YR 7/3) dry; common very fine roots; very strongly acid; clear smooth boundary.

Bt2—11 to 21 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; many faint dark yellowish brown (10YR 4/4) clay films on faces of peds; many faint yellowish brown (10YR 5/4) silt coatings on vertical faces of peds, distinct and light yellowish brown (10YR 6/4) dry; common very fine roots; very strongly acid; clear smooth boundary.

Bt3—21 to 27 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct strong brown (7.5YR 5/6) mottles; moderate coarse subangular blocky structure; firm; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; many faint yellowish brown (10YR 5/4) silt coatings on vertical faces of peds, distinct and light yellowish brown (10YR 6/4) and very pale brown (10YR 7/3) dry; few fine roots; few fine dark concretions of iron and manganese oxide; very strongly acid; abrupt wavy boundary.

2Btx—27 to 36 inches; yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) loam; weak very coarse prismatic structure parting to moderate thick platy; very firm; brittle; many distinct dark yellowish brown (10YR 4/4) clay films on faces of plates; many faint yellowish brown (10YR 5/4) silt coatings on faces of prisms, distinct and pale brown (10YR 7/3) and light yellowish brown (10YR 6/4) dry; few fine roots between prisms and few medium old roots on the top of prisms; about 5 percent small coarse fragments; many medium distinct dark concretions of iron and manganese oxide; very strongly acid; clear irregular boundary.

2Bt—36 to 57 inches; dark yellowish brown (10YR 4/4) clay loam, except for a thin layer of clay in the upper part of the horizon; common fine faint yellowish brown (10YR 5/6) mottles; moderate medium angular blocky and weak coarse subangular blocky structure; firm; many distinct brown (10YR 4/3) clay films on faces of peds; about 2 percent small coarse fragments; many medium dark concretions of iron and manganese oxide; strongly acid; gradual wavy boundary.

2BC—57 to 72 inches; yellowish brown (10YR 5/4) clay loam; many coarse distinct strong brown (7.5YR 5/6) and many medium faint brown (10YR 4/3) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; few distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; about 5 percent small coarse fragments; few medium dark concretions of iron and manganese oxide; neutral; gradual wavy boundary.

2C—72 to 80 inches; yellowish brown (10YR 5/4) loam; many medium faint yellowish brown (10YR 5/6) mottles; massive; firm; about 12 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. The thickness of the silty mantle ranges from 20 to 32 inches.

The Ap horizon has value of 4 or 5 and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The 2Btx horizon is loam, clay loam, or silt loam. The 2Bt horizon is dominantly clay loam or silty clay loam but in some pedons has a thin subhorizon of clay or silty clay in the upper part. The C horizon is loam or clay loam.

## Clermont Series

The Clermont series consists of deep, poorly drained soils on broad flats on the Illinoian till plain. These soils formed in Peorian loess and in the underlying gritty loess and glacial till. Permeability is very slow. Slopes are 0 to 2 percent.

Clermont soils are similar to Blanchester soils and are adjacent to Avonburg, Blanchester, and Rossmoyne soils. Avonburg soils are somewhat poorly drained and are on slight rises. They have a fragipan. Blanchester soils have a surface layer that is darker than that of the Clermont soils. They are in slight depressions. Rossmoyne soils are moderately well drained and are on rises, knolls, and divides between drainageways. They have a fragipan.

Typical pedon of Clermont silt loam, about 0.4 mile north of Centerville, in Sterling Township; 2,135 feet north of the intersection of Bodmand Road and Greenbush West Road, then 426 feet west:

Ap—0 to 7 inches; grayish brown (2.5Y 5/2) silt loam, light gray (10YR 7/2) dry; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium granular structure; very friable; many fine roots; few dark concretions of iron and manganese oxide; strongly acid; abrupt smooth boundary.

Eg—7 to 15 inches; light brownish gray (2.5Y 6/2) silt loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure parting to weak medium platy in the upper part; friable; common fine roots; common

faint pale brown (10YR 6/3) silt coatings on faces of peds; few dark concretions of iron and manganese oxide; very strongly acid; clear irregular boundary.

B/Eg—15 to 31 inches; light brownish gray (2.5Y 6/2) silty clay loam (Bt); many tongues of light brownish gray (2.5Y 6/2) silt loam (E) that are widest in the lower part of the horizon; common medium prominent yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; few fine roots; few faint grayish brown (2.5Y 5/2) clay films on faces of peds in the Bt part; very strongly acid; clear wavy boundary.

2Btg—31 to 44 inches; light brownish gray (2.5Y 6/2) silty clay loam; common medium prominent yellowish brown (10YR 5/8 and 5/4) mottles; weak medium prismatic structure parting to weak medium subangular blocky; dominantly firm, but very firm and brittle in about 10 percent of the middle part of the horizon; few fine roots in the upper part; many prominent light brownish gray (10YR 6/2) silt coatings on vertical faces of prisms; many prominent gray (10YR 6/1) and grayish brown (10YR 5/2) clay films on vertical faces of prisms; common dark soft accumulations and concretions of iron and manganese oxide; about 2 percent coarse fragments; very strongly acid; gradual wavy boundary.

2Bt1—44 to 56 inches; dark yellowish brown (10YR 4/4) clay loam in the upper part and clay in the lower part; common medium distinct yellowish brown (10YR 5/8) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; dominantly firm, but very firm and brittle in about 10 percent of the horizon; many prominent gray (10YR 6/1) and common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine roots; common dark soft accumulations and concretions of iron and manganese oxide; about 2 percent coarse fragments; medium acid in the upper part and neutral in the lower part; gradual wavy boundary.

3Bt2—56 to 72 inches; dark yellowish brown (10YR 4/4) clay loam and clay; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common fine roots concentrated in krotovinas; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; many prominent gray (10YR 6/1) clay films on horizontal faces of peds; common dark soft accumulations and concretions of iron and manganese oxide; common grayish brown krotovinas of silt loam; about 2 percent coarse fragments; neutral; gradual wavy boundary.

3Bt3—72 to 80 inches; yellowish brown (10YR 5/6) clay loam; many medium faint light olive brown (2.5Y 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular and angular blocky; firm; many prominent gray (10YR 6/1) and common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few dark soft accumulations and concretions of iron and manganese oxide; common gray (10YR 5/1) krotovinas; about 5 percent coarse fragments; neutral.

The thickness of the solum and the depth to carbonates range from 6 to 12 feet. The thickness of the loess ranges from 20 to 31 inches. The content of coarse fragments ranges from 2 to 10 percent in the till-derived part of the solum and in the substratum.

The Ap horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 1 or 2. The Eg horizon has hue of 2.5Y or 10YR, value of 5 or 6, and chroma of 1 or 2. The 2Bt and 3Bt horizons have chroma of 1 to 6. The 3Bt horizon is silty clay, clay loam, or clay.

## Eden Series

The Eden series consists of moderately deep, well drained, slowly permeable soils on hillsides and narrow shoulder slopes on uplands. These soils formed in material weathered from interbedded, soft, calcareous shale and limestone (fig. 12). Slopes range from 25 to 70 percent.

Eden soils are commonly adjacent to Faywood, Lowell, and Pate soils and are similar to Jessup and Pate soils. Lowell, Pate, and Jessup soils are deep over bedrock. Lowell soils are on ridgetops. Pate soils are on toe slopes and the lower parts of hillsides. Faywood soils do not have coarse fragments in the solum. They are on ridgetops and side slopes. Jessup soils formed partially in loess and glacial till at the head of drainageways and on side slopes along drainageways and in stream valleys.

Typical pedon of Eden flaggy silt loam, 25 to 40 percent slopes, about 3 miles southwest of Georgetown, in Lewis Township; about 3,829 feet east and 2,510 feet north of the intersection of Oak Grove Road and Utter Road:

A—0 to 5 inches; dark brown (10YR 3/3) flaggy silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; very friable; about 15 percent coarse fragments; neutral; clear smooth boundary.

BA—5 to 9 inches; brown (10YR 4/3) flaggy silty clay loam; moderate medium subangular blocky structure; friable; continuous dark brown (10YR 3/3)

organic coatings; about 20 percent coarse fragments; neutral; abrupt smooth boundary.

Bt1—9 to 17 inches; yellowish brown (10YR 5/4) flaggy clay; moderate medium subangular blocky structure; firm; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 25 percent coarse fragments; neutral; gradual wavy boundary.

Bt2—17 to 25 inches; light olive brown (2.5Y 5/4) flaggy silty clay; moderate fine subangular blocky structure; firm; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; many fine distinct brown (10YR 5/3) variegations; about 25 percent coarse fragments; neutral; gradual wavy boundary.

Bt3—25 to 34 inches; light olive brown (2.5Y 5/4) flaggy silty clay; weak medium subangular blocky structure; firm; very few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common fine distinct brown (10YR 5/3) variegations; about 30 percent coarse fragments; neutral; clear wavy boundary.

Cr—34 to 60 inches; interbedded, fossiliferous limestone and soft silty clay shale; strong effervescence; moderately alkaline.

The depth to paralithic contact and the thickness of the solum range from 20 to 40 inches. Interbedded shale and limestone are below the paralithic contact. The content of coarse fragments, mainly limestone flagstones, ranges, by volume, from 5 to 20 percent in the A horizon and from 10 to 30 percent in the Bt horizon.

The A horizon generally is less than 6 inches thick. It has hue of 10YR or 2.5Y and chroma of 2 or 3. The Bt horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 3 to 6. It is silty clay, clay, or the flaggy analogs of those textures. Some pedons have a C horizon.

## Elkinsville Series

The Elkinsville series consists of deep, well drained soils on glacial outwash terraces along the Ohio River. These soils formed in silty and loamy outwash or old alluvium. Permeability is moderate. Slopes range from 2 to 12 percent.

Elkinsville soils are similar to Williamsburg soils and commonly are adjacent to Sciotoville soils. Sciotoville soils have a fragipan. They are moderately well drained and are at the slightly lower elevations. Williamsburg soils have more sand and less silt in the solum than the Elkinsville soils. They are on terraces along streams that are tributaries of the Ohio River.

Typical pedon of Elkinsville silt loam, 2 to 6 percent slopes, about 0.5 mile northwest of Aberdeen, in

**Figure 12.—Typical profile of Eden soils, which formed in material weathered from interbedded shale and limestone.**

Huntington Township; 2,001 feet north and 810 feet west of the intersection of U.S. Highway 52 and State Route 41:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

Bt1—9 to 14 inches; yellowish brown (10YR 5/4) silt loam; weak fine and medium subangular blocky structure; few fine dark yellowish brown (10YR 4/4) clay films on faces of peds; friable; medium acid; gradual smooth boundary.

Bt2—14 to 37 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; firm; strongly acid; gradual wavy boundary.

2Bt3—37 to 50 inches; yellowish brown (10YR 5/4) sandy loam; few faint clay films on faces of peds and bridging sand grains; moderate coarse subangular blocky structure; friable; strongly acid; clear smooth boundary.

2BC—50 to 63 inches; dark brown (7.5YR 4/2) sandy loam; weak coarse subangular blocky structure; friable; strongly acid; diffuse smooth boundary.

2C—63 to 80 inches; dark yellowish brown (10YR 4/4) fine sandy loam that has a few very thin lenses of fine gravel; massive; very friable; slightly acid.

The solum ranges from 40 to 70 inches in thickness. The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The Bt horizon has chroma of 4 to 6. The 2Bt horizon has colors similar to those of the Bt horizon. It is silt loam, sandy loam, or loam.

## Faywood Series

The Faywood series consists of moderately deep, well drained, slowly or moderately slowly permeable soils on side slopes and ridgetops on unglaciated uplands. These soils formed in residuum of interbedded limestone and shale bedrock. Slopes range from 8 to 25 percent.

Faywood soils are commonly adjacent to Lowell and Eden soils and are similar to Jessup, Lowell, and Pate soils. The similar soils are deeper over bedrock than the Faywood soils. Jessup soils formed at least partially in glacial till. They are at the head of drainageways and on side slopes along drainageways and in stream valleys. Lowell soils are on the tops of ridges in the uplands. Pate soils are on toe slopes and the lower parts of hillsides. Eden soils have a flaggy surface layer and have a higher content of coarse fragments in the solum than the Faywood soils. They are on steep hillsides and valley walls.

Typical pedon of Faywood silt loam, in an area of Faywood-Lowell silt loams, 8 to 15 percent slopes, eroded; about 1.4 miles southwest of Heitt, in Huntington Township; 3,251 feet south and 4,311 feet west of the intersection of North Pole Road and Scoffield Road:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; common very fine roots; about 25 percent yellowish brown (10YR 5/4) material from the B horizon; medium acid; abrupt smooth boundary.

Bt1—9 to 16 inches; yellowish brown (10YR 5/6) silty clay; weak medium subangular blocky structure; firm; few very fine roots; very few faint brown (10YR 5/3) clay films on faces of peds; few very fine pores; common fine distinct dark concretions of iron and manganese oxide; medium acid; gradual wavy boundary.

Bt2—16 to 22 inches; yellowish brown (10YR 5/6) silty clay; common fine distinct brown (10YR 5/3) mottles; moderate fine subangular blocky structure; firm; few very fine roots; many distinct brown (10YR 5/3) clay films on faces of peds; few very fine pores; common fine distinct dark concretions and stains of iron and manganese oxide; medium acid; gradual wavy boundary.

BC—22 to 28 inches; olive brown (2,5Y 4/4) silty clay; common fine distinct olive gray (5Y 5/2) mottles; weak coarse subangular blocky structure; firm; few very fine roots; few very fine pores; common medium distinct dark concretions of iron and manganese oxide; medium acid; clear wavy boundary.

R—28 to 30 inches; hard limestone interbedded with calcareous shale.

The thickness of the solum and the depth to calcareous, interbedded limestone and shale range from 20 to 40 inches. The content of coarse fragments ranges from 0 to 10 percent in the solum.

The Ap horizon has chroma of 2 or 3. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6.

## Genesee Series

The Genesee series consists of deep, well drained soils that formed in alluvium on flood plains. Permeability is moderate. Slopes are 0 to 2 percent.

The Genesee soils in this county have more sand and less clay than is definitive for the series. This difference, however, does not affect the use and management of the soils.

Genesee soils are commonly adjacent to Bonnell and Rossmoyne soils and are similar to Jules and Nolin soils. Bonnell and Rossmoyne soils are underlain by glacial till and have an argillic horizon. Bonnell soils are on side slopes in stream valleys. Rossmoyne soils are on side slopes along drainageways. Jules soils have free carbonates throughout the control section. Nolin soils have less than 15 percent fine sand. They are coarser textured in the control section than the Genesee soils.

Typical pedon of Genesee silt loam, occasionally flooded, about 0.3 mile north of Sardinia, in Washington Township; 1,300 feet south of the intersection of State Routes 134 and 32, then 279 feet west:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; neutral; abrupt smooth boundary.

C1—9 to 16 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; neutral; clear smooth boundary.

C2—16 to 24 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; thin strata of loam; neutral; gradual smooth boundary.

C3—24 to 36 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; thin strata of fine sandy loam and silt loam; slight effervescence; mildly alkaline; gradual wavy boundary.

C4—36 to 60 inches; brown (10YR 5/3), stratified loam and fine sandy loam; about 3 percent coarse fragments; massive; friable; slight effervescence; mildly alkaline.

The Ap horizon has chroma of 2 or 3. The part of the C horizon within a depth of 40 inches has value of 3 to 5 and chroma of 3 or 4.

## Jessup Series

The Jessup series consists of deep, well drained, slowly permeable soils at the head of drainageways and on side slopes along drainageways and in stream valleys. These soils formed in loess, glacial till, and clayey material weathered from shale and limestone. Slopes range from 8 to 25 percent.

Jessup soils are similar to Bonnell, Eden, Faywood, Lowell, and Pate soils and are commonly adjacent to Loudon and Rossmoyne soils. Loudon soils are moderately well drained and are on knolls and ridges and at the head of drainageways. They generally have a solum that is thicker than that of the Jessup soils. Rossmoyne soils are moderately well drained and are on knolls, at the head of drainageways, and on side slopes along drainageways. They have deposits of till that are thicker than those in the Jessup soils. Bonnell soils formed dominantly in glacial till and in places in a thin mantle of loess. They are on side slopes in stream valleys. Eden, Faywood, Lowell, and Pate soils have no glacial till in the solum. Eden and Faywood soils have bedrock within a depth of 40 inches. Eden soils are on hillsides. Faywood soils are on ridgetops and side slopes. Lowell soils are on ridgetops. Pate soils are on toe slopes and the lower parts of hillsides.

Typical pedon of Jessup silt loam, 15 to 25 percent slopes, eroded, about 1.75 miles south of Red Oak, in Union Township; 4,101 feet east of the intersection of U.S. Highways 62 and 68 and Gardner Road, then 1,650 feet south:

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; many roots; mixed by tillage with about 25 percent yellowish brown (10YR 5/4) material from the B horizon; medium acid; clear smooth boundary.

Bt1—6 to 15 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; firm; common roots; few faint dark yellowish brown (10YR 4/4) clay films on vertical faces of peds; brown (10YR 5/3) silt coatings on faces of peds; about 1 percent coarse fragments; strongly acid; clear wavy boundary.

2Bt2—15 to 25 inches; brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; few faint brown (10YR 4/3) clay films on faces of peds; brown (10YR 5/3) silt coatings; about 5 percent coarse fragments; strongly acid; clear wavy boundary.

2Bt3—25 to 32 inches; yellowish brown (10YR 5/4) silty clay loam; moderate coarse and medium subangular blocky structure; firm; common faint brown (10YR 5/3) clay films on faces of peds; common dark stains and concretions of iron and manganese oxide; about 5 percent coarse fragments; medium acid; clear wavy boundary.

2Bt4—32 to 42 inches; yellowish brown (10YR 5/6) clay; weak coarse prismatic structure parting to moderate fine angular blocky; firm; very few faint yellowish brown (10YR 5/4) clay films on faces of peds; few medium dark stains and concretions of iron and manganese oxide; about 5 percent coarse fragments; medium acid; clear wavy boundary.

3Bt—42 to 55 inches; light olive brown (2.5Y 5/4) clay; weak coarse prismatic structure parting to moderate medium angular blocky; firm; very few faint yellowish brown (10YR 5/4) clay films on faces of peds; slightly acid; gradual wavy boundary.

3C—55 to 80 inches; light olive brown (2.5Y 5/4) and grayish brown (2.5Y 5/2) silty clay; massive; very firm; slightly acid.

The solum ranges from 30 to 60 inches in thickness. The thickness of the silty mantle ranges from 10 to 24 inches.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The 3Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 to 6. It is clay or silty clay. The 3C horizon also is clay or silty clay. It has chroma of 2 to 4.

## Jules Series

The Jules series consists of deep, well drained soils that formed in calcareous, silty alluvium on flood plains. Permeability is moderate. Slopes are 0 to 2 percent.

Jules soils are commonly adjacent to Nolin soils and are similar to Genesee and Nolin soils. Genesee soils have more sand and clay between depths of 10 and 40 inches than the Jules soils. Nolin soils are not calcareous and have a cambic horizon.

Typical pedon of Jules silt loam, frequently flooded, about 1.9 miles southeast of Ripley, in Huntington Township; 2,310 feet south of the intersection of Scoffield Road and Howard Hill Road, then 1,581 feet west:

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; few fine roots; slight effervescence; moderately alkaline; abrupt smooth boundary.

C1—7 to 40 inches; brown (10YR 4/3) silt loam; weak very coarse subangular blocky structure; friable; few fine roots; few faint brown (7.5YR 4/4) fillings in old root channels; few thin layers of silt loam that has less clay than the rest of the horizon; slight effervescence; moderately alkaline; diffuse smooth boundary.

C2—40 to 60 inches; brown (10YR 4/3) silt loam; weak very coarse subangular blocky structure; friable; few thin layers of silt loam that has less clay than the rest of the horizon; slight effervescence; moderately alkaline.

The Ap horizon has chroma of 3 or 4. The C horizon has value of 4 or 5 and chroma of 3 or 4.

## Loudon Series

The Loudon series consists of deep, moderately well drained soils on knolls and ridges and at the head of drainageways on the Illinoian till plain. These soils formed in a thin layer of loess, in glacial till, and in residuum derived from interbedded shale and limestone. Permeability is slow. Slopes range from 3 to 8 percent.

Loudon soils are similar to Lowell soils and are commonly adjacent to Avonburg, Jessup, and Rossmoyne soils. Avonburg and Rossmoyne soils do not have a solum that formed partially in limestone and shale residuum. They have deposits of till that are thicker than those on the Loudon soils. Rossmoyne soils have a fragipan. They are in the lower, sloping areas and in the higher, more nearly level areas. Avonburg soils are somewhat poorly drained and are in the lower landscape positions. Jessup soils are well drained. They generally have a solum that is thinner than that of the Loudon soils. Lowell soils formed in loess and residuum and have no glacial till.

Typical pedon of Loudon silt loam, 3 to 8 percent slopes, eroded, about 0.6 mile northeast of Ash Ridge, in Jackson Township; about 2,651 feet south and 1,175 feet west of the intersection of U.S. Highway 62 and County Route 17 (Ash Ridge Arnheim Schwallie Road):

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; mixed by tillage with about 10 percent yellowish brown (10YR 5/6) subsoil material; strongly acid; abrupt smooth boundary.

Bt1—7 to 14 inches; yellowish brown (10YR 5/6) silty clay loam; few medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; very few faint yellowish brown (10YR 5/4) clay films on faces of peds; few coarse black (10YR 2/1) stains and concretions of iron and manganese oxide; medium acid; clear wavy boundary.

2Bt2—14 to 31 inches; yellowish brown (10YR 5/6) silty clay loam; many medium distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few faint brown (10YR 5/3) and yellowish brown (10YR 5/4) clay films on faces of peds; few coarse fragments; few fine black concretions of iron and manganese oxide; medium acid; gradual wavy boundary.

2Bt3—31 to 37 inches; strong brown (7.5YR 5/6) clay; many medium distinct reddish brown (5YR 5/4) and light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few faint

strong brown (7.5YR 5/6) clay films on faces of peds; about 3 percent coarse fragments; medium acid; clear wavy boundary.

3Bt4—37 to 49 inches; yellowish brown (10YR 5/4) silty clay; few medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; very firm; few slickensides; few distinct strong brown (7.5YR 5/6) clay films on faces of peds; neutral; gradual wavy boundary.

3BC—49 to 59 inches; dark yellowish brown (10YR 4/4) clay; weak coarse subangular blocky structure; very firm; many light gray (10YR 7/2) soft accumulations of calcium carbonate in the lower part of the horizon; neutral in the matrix; clear wavy boundary.

3Cr—59 to 72 inches; light olive brown (2.5Y 5/4), interbedded, calcareous shale and limestone; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 45 to 70 inches. The depth to carbonates ranges from 45 to 60 inches. The thickness of the loess ranges from 10 to 24 inches, and the thickness of the till ranges from 10 to 30 inches. The depth to residuum is 30 to 44 inches, and the depth to interbedded shale and limestone is 48 to 79 inches.

The Ap horizon has chroma of 2 or 3. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Bt horizon has value of 4 or 5 and chroma of 4 to 6. It has few to as much as 5 percent coarse fragments.

## Lowell Series

The Lowell series consists of deep, well drained soils on the unglaciated tops of ridges on uplands in the southeastern part of the county. These soils formed in loess and in the underlying clayey material weathered from calcareous shale and thin strata of limestone. Permeability is moderately slow in the subsoil. Slopes range from 3 to 15 percent.

Lowell soils are similar to Jessup, Loudon, and Pate soils and are commonly adjacent to Eden and Faywood soils. Eden and Faywood soils have shale and limestone bedrock within a depth of 40 inches. Jessup and Loudon soils formed partially in glacial till. Loudon soils are wetter than the Lowell soils. Pate soils formed entirely in colluvium.

Typical pedon of Lowell silt loam, in an area of Faywood-Lowell silt loams, 8 to 15 percent slopes, eroded; about 1 mile east of Ripley, in Union Township; 650 feet north of the intersection of Howard Ridge Road and DeVore Road, then 951 feet west:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; many roots; slightly acid; abrupt smooth boundary.

Bt1—6 to 16 inches; yellowish brown (10YR 5/6) silty clay loam; weak medium subangular blocky structure; firm; common roots; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; slightly acid; clear smooth boundary.

2Bt2—16 to 21 inches; yellowish brown (10YR 5/6) silty clay loam; few faint light yellowish brown (10YR 6/4) silt coatings on faces of peds; moderate medium subangular blocky structure; firm; few roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; slightly acid; clear smooth boundary.

2Bt3—21 to 29 inches; dark yellowish brown (10YR 4/4) silty clay; few faint light yellowish brown (2.5Y 6/4) silt coatings on faces of peds; many fine distinct dark grayish brown (2.5Y 4/2) and few fine distinct yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; firm; very few faint dark yellowish brown (10YR 4/6) clay films on faces of peds; common black stains and concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

2Bt4—29 to 40 inches; light olive brown (2.5Y 5/4) clay; common fine distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; very few faint dark yellowish brown (10YR 4/6) clay films on faces of peds; common black stains and concretions of iron and manganese oxide; slightly acid; clear wavy boundary.

2Bt5—40 to 44 inches; light olive brown (2.5Y 5/4) clay; common fine distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; few prominent dark yellowish brown (10YR 4/6) clay films on faces of peds; few black stains and concretions of iron and manganese oxide; neutral; gradual wavy boundary.

2R—44 to 56 inches; interbedded, calcareous shale and layers of limestone 1 to 4 inches thick.

The thickness of the solum ranges from 40 to 60 inches. The depth to interbedded shale and limestone ranges from 40 to 70 inches.

The Ap horizon has hue of 10YR or 7.5YR and chroma of 2 to 4. The 2Bt horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 4 to 6.

## Nolin Series

The Nolin series consists of deep, well drained soils on flood plains. These soils formed in alluvium that washed from soils formed in material from shale, sandstone, and limestone. Permeability is moderate. Slopes are 0 to 2 percent.

Nolin soils are commonly adjacent to Elkinsville and Sciotoville soils and are similar to Genesee and Jules soils. Elkinsville and Sciotoville soils are on low outwash terraces. They have an argillic horizon. Elkinsville, Sciotoville, and Genesee soils have more sand and less silt between depths of 10 and 40 inches than the Nolin soils. Jules soils have free carbonates throughout the control section.

Typical pedon of Nolin silt loam, occasionally flooded, about 4 miles southwest of Higginsport, in Lewis Township; 1,211 feet south of the intersection of Buckeye Road and U.S. Highway 52, then 499 feet west:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many roots; many dark brown (10YR 3/3) coatings on faces of peds; clear smooth boundary.

Bw1—9 to 20 inches; brown (10YR 4/3) silt loam; moderate medium subangular blocky structure; friable; many roots; common dark brown (10YR 3/3) coatings on faces of peds; slightly acid; gradual wavy boundary.

Bw2—20 to 52 inches; brown (10YR 4/3) silty clay loam; moderate medium and coarse subangular blocky structure; firm; about 2 percent coarse fragments; few roots in the upper part; few dark brown (10YR 3/3) faces of peds; medium acid; gradual wavy boundary.

C—52 to 72 inches; brown (7.5YR 4/4) loam; massive; friable; medium acid.

The solum is 40 or more inches thick. The thickness of the alluvial deposits ranges from 40 inches to many feet.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3. The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. The C horizon has hue, value, and chroma similar to those of the Bw horizon. It is silt loam, silty clay loam, loam, or the gravelly analogs of those textures. It is stratified in some pedons.

## Pate Series

The Pate series consists of deep, moderately well drained and well drained soils on toe slopes and the lower parts of hillsides on uplands. These soils formed in clayey colluvium derived from interbedded shale and limestone, dominantly from shale. Permeability is very slow. Slopes range from 8 to 35 percent.

Pate soils are commonly adjacent to Eden and Elkinsville soils and are similar to Eden, Faywood, Jessup, and Lowell soils. Eden and Faywood soils are moderately deep over bedrock. Eden soils are commonly on the steeper, higher parts of the landscape. Jessup and Lowell soils formed partially in loess, and Jessup soils formed partially in glacial till. Elkinsville soils are on terraces along rivers. They have more silt and less clay in the subsoil than the Pate soils.

Typical pedon of Pate silty clay, 25 to 35 percent slopes, eroded, about 1 mile west of Levanna, in Union Township; 3,399 feet east of the intersection of County Road 307 and U.S. Highway 52, then 1,401 feet south:

Ap—0 to 4 inches; dark brown (10YR 3/3) silty clay, brown (10YR 5/3) dry; strong fine granular structure; firm; about 2 percent coarse fragments; many roots; neutral; abrupt wavy boundary.

Bt1—4 to 16 inches; brown (10YR 4/3) silty clay; moderate medium subangular blocky structure; firm; about 2 percent coarse fragments; common roots; few faint dark brown (10YR 3/3) clay films on faces of peds; neutral; gradual wavy boundary.

Bt2—16 to 32 inches; brown (10YR 4/3) silty clay; moderate medium angular blocky structure; firm; about 3 percent coarse fragments; few roots; thin patchy dark brown (10YR 3/3) clay films on faces of peds; neutral; clear wavy boundary.

Bt3—32 to 44 inches; dark grayish brown (2.5Y 4/2) and olive brown (2.5Y 4/4) flaggy silty clay; moderate medium subangular blocky structure; very firm; about 20 percent coarse fragments; few roots; very few faint dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; gradual wavy boundary.

BC—44 to 75 inches; olive brown (2.5Y 4/4) flaggy silty clay; common medium distinct grayish brown (10YR 5/2) mottles in the lower part of the horizon; weak thin platy structure parting to weak fine subangular blocky; very firm; about 20 percent coarse fragments; few roots; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—75 to 80 inches; interbedded, light olive brown (2.5Y 5/4) and gray (N 5/0), calcareous shale and limestone; strong effervescence; moderately alkaline.

The solum ranges from 50 to 75 inches in thickness. The content of coarse fragments ranges from 0 to 10 percent in the upper part of the solum and from 15 to 30 percent in the lower part.

The Ap horizon has value and chroma of 3 or 4. The Bt and BC horizons have value of 4 or 5. They are silty clay loam, silty clay, clay, or the flaggy analogs of those textures.

## Rossmoyne Series

The Rossmoyne series consists of deep, moderately well drained soils on knolls, at the head of drainageways, and on the side slopes along drainageways on the Illinoian till plain. These soils formed in loess and in the underlying glacial till. They have a fragipan. Permeability is moderate in the upper part of the profile and slow or moderately slow in the fragipan. Slopes range from 1 to 12 percent.

Rossmoyne soils are commonly adjacent to Avonburg, Bonnell, Cincinnati, Clermont, Jessup, and Loudon soils and are similar to Cincinnati soils. Avonburg soils are somewhat poorly drained and are in the less sloping areas. Bonnell, Clermont, Jessup, and Loudon soils do not have a fragipan. Bonnell soils are on side slopes, and Clermont soils are on flats. Cincinnati soils are well drained. They are slightly higher on the landscape than the Rossmoyne soils. Jessup and Loudon soils are in landscape positions similar to those of the Rossmoyne soils. They commonly are shallower to bedrock than the Rossmoyne soils.

Typical pedon of Rossmoyne silt loam, 1 to 6 percent slopes, about 2.7 miles north of Higginsport, in Lewis Township; 2,201 feet south of the intersection of Utter Road and Oak Grove Road, then 1,250 feet west:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure parting to weak medium granular; friable; few fine roots; medium acid; abrupt smooth boundary.

Bt1—9 to 15 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; few faint brown (10YR 5/3) clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt2—15 to 20 inches; yellowish brown (10YR 5/6) silty clay loam; common fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few prominent brown (10YR 5/3) clay films on faces of peds; few fine roots; very strongly acid; clear wavy boundary.

2Btx—20 to 38 inches; yellowish brown (10YR 5/6) clay loam; many medium distinct grayish brown (10YR 5/2) mottles; weak very coarse prismatic structure parting to moderate thick platy; very firm; brittle; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; light brownish gray (10YR 6/2) silt coatings on faces of peds; about 3 percent coarse fragments; few black concretions of iron and manganese oxide; very strongly acid; gradual wavy boundary.

2Bt1—38 to 50 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common black stains and concretions of iron and manganese oxide; about 3 percent coarse fragments; medium acid; gradual wavy boundary.

2Bt2—50 to 68 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; few distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common black stains and concretions of iron and manganese oxide; about 3 percent coarse fragments; slightly acid; clear wavy boundary.

2BC—68 to 74 inches; yellowish brown (10YR 5/6) clay loam; few fine faint yellowish brown (10YR 5/8) and common medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; few light gray (10YR 7/1) limestone ghosts; about 5 percent coarse fragments; slight effervescence; mildly alkaline; clear wavy boundary.

2C—74 to 78 inches; yellowish brown (10YR 5/4) loam; common medium distinct yellowish brown (10YR 5/8) mottles; massive; very firm; light gray (10YR 7/2) coatings along cleavage planes; about 8 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 65 to 120 inches. The thickness of the loess mantle ranges from 18 to 40 inches. Depth to the fragipan is 18 to 30 inches. The fragipan is 18 to 30 inches thick.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. It is silt loam or silty clay loam. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Btx horizon has value of 4 or 5 and chroma of 4 to 6. It is silt loam, loam, clay loam, or silty clay loam. The 2Bt and 2BC horizons have hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 3 to 6. They range from loam to clay. The 2C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 3 to 6. It is loam, clay loam, or clay.

## Sardinia Series

The Sardinia series consists of deep, moderately well drained soils on terraces. These soils formed in stratified, silty and loamy outwash or in old alluvium. Permeability is moderate or moderately slow. Slopes range from 1 to 6 percent.

Sardinia soils are similar to Williamsburg soils and

are adjacent to Genesee, Bonnell, and Rossmoyne soils. Williamsburg soils have a subsoil that is browner than that of the Sardinia soils. They are on the higher or more sloping parts of the landscape. Genesee soils are on flood plains and are well drained. Bonnell soils are on steep side slopes and are well drained. They are underlain by till. Rossmoyne soils have a fragipan and are underlain by till. They are in the higher positions on the landscape.

Typical pedon of Sardinia silt loam, 1 to 6 percent slopes, about 2.25 miles north of Fayetteville, in Perry Township; 2,850 feet east of the intersection of Glady Road and Morgan Road:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

Bt1—9 to 14 inches; brown (10YR 4/3) silt loam; weak fine and medium subangular blocky structure; friable; few fine roots; common distinct brown (10YR 5/3) silt coatings on faces of peds; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; slightly acid; clear wavy boundary.

Bt2—14 to 24 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine faint light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; many distinct brown (7.5YR 4/4) clay films on faces of peds; medium acid; clear wavy boundary.

Bt3—24 to 35 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; common distinct pale brown (10YR 6/3) silt coatings on faces of peds; common distinct brown (10YR 4/3) clay films on faces of peds; strongly acid; clear wavy boundary.

2Btx—35 to 50 inches; dark yellowish brown (10YR 4/4) clay loam; many medium distinct grayish brown (10YR 5/2) mottles; moderate coarse subangular blocky structure; firm; slightly brittle; few faint brown (10YR 5/3) clay films on vertical faces of peds; about 2 percent coarse fragments; strongly acid; diffuse smooth boundary.

2BC—50 to 64 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak thick platy structure parting to moderate coarse subangular blocky; firm; about 5 percent coarse fragments; neutral; clear wavy boundary.

2C—64 to 80 inches; yellowish brown (10YR 5/4 and 5/6) and grayish brown (10YR 5/2) sandy clay loam; massive; friable; about 8 percent coarse fragments; neutral.

The solum ranges from 60 to 85 inches in thickness. The content of coarse fragments, mainly waterworn limestone fragments, ranges from 0 to 5 percent in the A and Bt horizons and from 2 to 15 percent in the 2Btx, 2BC, and 2C horizons.

The Bt and 2Btx horizons have value of 4 or 5 and chroma of 3 to 6. Mottles with chroma of 2 or less are within the upper 10 inches of the argillic horizon. Some pedons do not have a brittle layer. The 2C horizon has value of 4 or 5 and chroma of 2 to 6.

## Sciotoville Series

The Sciotoville series consists of deep, moderately well drained soils on terraces along the Ohio River. These soils formed in old alluvium. They have a fragipan. Permeability is moderate in the upper part of the subsoil and slow or moderately slow in the fragipan. Slopes are 0 to 3 percent.

Sciotoville soils are commonly adjacent to Nolin and Elkinsville soils. Nolin foils formed in recent alluvium on flood plains. Elkinsville soils are well drained and are on the same terraces as the Sciotoville soils. They do not have a fragipan.

Typical pedon of Sciotoville silt loam, 0 to 2 percent slopes, in Aberdeen, in Huntington Township; 1,650 feet south and 16 feet east of the intersection of Flaugher Hill Road and U.S. Highway 52:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, grayish brown (10YR 5/2) dry; weak medium granular structure; friable; about 1 percent pebbles; medium acid; abrupt smooth boundary.

BA—9 to 12 inches; brown (10YR 4/3) silt loam; weak coarse subangular blocky structure; friable; about 1 percent pebbles; brown (7.5YR 5/2) silt coatings on faces of peds; strongly acid; clear smooth boundary.

Bt1—12 to 18 inches; brown (7.5YR 4/4 and 10YR 5/3) silt loam; moderate fine and medium subangular blocky structure; friable; about 1 percent pebbles; brown (7.5YR 5/2) silt coatings on faces of peds; very few faint brown (10YR 4/3) clay films on faces of peds; fine mica flakes evident in sunlight; very strongly acid; clear wavy boundary.

Bt2—18 to 25 inches; brown (7.5YR 4/4 and 10YR 5/3) silty clay loam; common fine distinct grayish brown (10YR 5/2) mottles; moderate medium and coarse subangular blocky structure; firm; about 2 percent pebbles; brown (7.5YR 5/2) silt coatings on faces of peds; common faint brown (10YR 4/3) clay films on

faces of peds; common black concretions of iron and manganese oxide; very strongly acid; clear wavy boundary.

Bt3—25 to 31 inches; brown (7.5YR 4/4) silt loam; common fine distinct grayish brown (10YR 5/2) mottles; weak coarse prismatic structure parting to moderate medium angular blocky; firm; about 2 percent pebbles; common distinct brown (10YR 4/3) clay films on faces of peds; common black concretions of iron and manganese oxide; very strongly acid; gradual smooth boundary.

Btx—31 to 42 inches; brown (7.5YR 4/4) silt loam; common fine distinct grayish brown (10YR 5/2) mottles; weak very coarse prismatic structure; very firm; brittle; about 2 percent pebbles; common distinct brown (10YR 4/3) clay films on faces of peds; common black concretions of iron and manganese oxide; strongly acid; gradual wavy boundary.

BC—42 to 57 inches; brown (7.5YR 4/4) loam; few medium distinct grayish brown (10YR 5/2) and brown (10YR 5/3) mottles; massive; firm; about 3 percent pebbles; strongly acid; clear wavy boundary.

C—57 to 60 inches; brown (7.5YR 4/4) loam that has strata of silt loam and fine sandy loam; massive; friable; about 4 percent pebbles; medium acid.

The solum ranges from 45 to 70 inches in thickness. Depth to the fragipan ranges from 20 to 32 inches. The content of coarse fragments ranges from 0 to 2 percent in the A horizon, from 1 to 5 percent in the Bt horizon, and from 1 to 10 percent in the C horizon.

The Ap horizon has chroma of 2 or 3. The C horizon has value of 4 or 5 and chroma of 3 to 6.

## Shoals Series

The Shoals series consists of deep, somewhat poorly drained soils that formed in alluvium on flood plains. Permeability is moderate. Slopes are 0 to 2 percent.

Shoals soils are commonly adjacent to Avonburg and Rossmoyne soils. The adjacent soils formed in loess and glacial till on uplands.

Typical pedon of Shoals silt loam, frequently flooded, about 5 miles northeast of Mt. Orab, in Green Township; 742 feet north of the intersection of Mood Road and Mount Road, then 20 feet east:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; few fine roots; neutral; abrupt smooth boundary.

C1—8 to 13 inches; brown (10YR 5/3) loam; many medium distinct grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; neutral; gradual smooth boundary.

C2—13 to 30 inches; light brownish gray (10YR 6/2) and yellowish brown (10YR 5/4) loam; common medium distinct brown (10YR 4/3) mottles; weak coarse subangular blocky structure; friable; slightly acid; gradual smooth boundary.

C3—30 to 41 inches; grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; firm; about 5 percent pebbles; neutral; gradual smooth boundary.

C4—41 to 52 inches; dark yellowish brown (10YR 4/4) loam; many medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; about 10 percent pebbles; mildly alkaline; gradual smooth boundary.

C5—52 to 60 inches; yellowish brown (10YR 5/4) loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; firm; about 10 percent pebbles; strong effervescence; moderately alkaline.

The part of the C horizon within a depth of 40 inches has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. This horizon is sandy loam, silt loam, or loam.

## Williamsburg Series

The Williamsburg series consists of deep, well drained soils on terraces. These soils formed in a thin mantle of loess and in the underlying stratified, silty and loamy glacial outwash or old alluvium. Permeability is moderate. Slopes range from 2 to 6 percent.

Williamsburg soils are similar to Elkinsville and Sardinia soils and are commonly adjacent to Bonnell, Eden, and Genesee soils. Elkinsville soils have more silt and less sand in the solum than the Williamsburg soils. Sardinia soils are wetter than the Williamsburg soils. Bonnell and Genesee soils are well drained. Bonnell soils are underlain by Illinoian till. Genesee soils are on flood plains. Eden soils have shale and limestone bedrock within a depth of 40 inches.

Typical pedon of Williamsburg silt loam, 2 to 6 percent slopes, about 3.75 miles northeast of Fayetteville, in Perry Township; 850 feet south of the intersection of State Routes 123 and 251, then 2,560 feet east:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure;

friable; slightly acid; abrupt smooth boundary.

BA—9 to 14 inches; brown (10YR 4/3) silt loam; weak fine and medium subangular blocky structure; friable; thin patchy dark brown (10YR 3/3) and brown (10YR 4/3) organic coatings on faces of peds; medium acid; clear wavy boundary.

Bt1—14 to 21 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; very few faint dark brown (10YR 4/3) clay films on faces of peds; strongly acid; gradual wavy boundary.

2Bt2—21 to 33 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; very few faint dark brown (10YR 4/3) clay films on faces of peds; few fine dark concretions of iron and manganese oxide; about 3 percent coarse fragments, mostly small, semirounded pebbles; strongly acid; gradual wavy boundary.

2Bt3—33 to 43 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; few faint brown (7.5YR 5/4) clay films on faces of peds; few fine dark concretions of iron and manganese oxide; about 5 percent coarse fragments; strongly acid; gradual wavy boundary.

2Bt4—43 to 80 inches; brown (10YR 4/3) sandy clay loam; common fine distinct brown (10YR 5/3) and yellowish brown (10YR 5/5) mottles; weak coarse subangular blocky structure; firm; few faint brown (10YR 4/3) clay films on faces of peds; common fine dark concretions of iron and manganese oxide; about 10 percent fine gravel; medium acid in the upper part and neutral in the lower part.

The thickness of the solum ranges from 60 to more than 80 inches. The thickness of the silty mantle ranges from 12 to 24 inches.

The Ap horizon has chroma of 2 or 3. The Bt horizon has value of 4 or 5 and chroma of 3 to 5. It is silt loam or silty clay loam. The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is dominantly sandy clay loam but has subhorizons of clay loam, sandy clay, or silt loam. Some pedons have a C horizon. This horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is dominantly sandy clay loam, sandy loam, or gravelly loam but has thin strata of silty clay loam.

# Formation of the Soils

This section relates the major factors of soil formation to the soils in Brown County and explains some of the processes of soil formation.

## Factors of Soil Formation

The most important factors of soil formation are parent material, climate, living organisms, topography, and time *(8)*. Climate and living organisms, particularly vegetation, are the active factors of soil formation. Their effect on the parent material is modified by topography and by the length of time that the processes of soil formation have been active. The relative importance of each factor differs from place to place. In some areas one factor dominates and is responsible for most of the soil properties. Normally, however, the interaction of all five factors determines the kind of soil that forms in any given place.

### Parent Material

The soils in Brown County formed in several types of geologic material, including loess, glacial till, glacial outwash, material weathered from shale and limestone, colluvial sediments, and alluvial sediments. Most of the soils formed in a combination of at least two kinds of parent material. Table 20 shows the relationship between the parent material and the drainage class, depth, and landscape position of the soils in the county.

Loess is wind-deposited material. It has been deposited throughout the county. It is about 2 to 3 feet thick in most areas. In many areas it has been completely removed by erosion. Most of the loess was deposited during the Wisconsin glacial age. Originally, it was high in content of lime and was made up mainly of silt-sized particles. The upper part of many of the soils in the county formed in loess. Examples are Rossmoyne, Avonburg, Clermont, and Lowell soils.

Glacial till is the dominant parent material in all parts of the county, except for the southeastern part. The till was deposited by the Illinoian glacier. It has a high content of lime. Unweathered glacial till generally is loam that has about 2 to 5 percent coarse fragments. Most of the coarse fragments are local rock fragments, but some of the igneous rocks are from Canada. Bonnell soils formed almost entirely in glacial till. Rossmoyne, Avonburg, Clermont, and Jessup soils formed partly in glacial till.

Glacial outwash is material deposited by the floodwater of melting glaciers. This material is generally along present stream valleys, commonly high above the stream channels. Sardinia, Williamsburg, Elkinsville, and Sciotoville soils formed dominantly in this material.

Many of the soils in the county formed in material weathered from clayey shale and limestone bedrock. The part of the solum that formed in this material is very high in content of clay. Faywood, Lowell, Loudon, and Jessup soils formed partly in this material. Eden soils formed entirely in this material. This residuum is the dominant parent material in the southeastern part of the county, which was never covered by the Illinoian glacier.

Colluvium is material that has been moved downslope by gravity. It is at the base of slopes near the Ohio River and its tributaries. The material is derived from clayey shale and limestone bedrock. Pate soils formed in colluvium.

Alluvium is material deposited by the floodwater of overflowing streams. The texture of this material ranges from silt to sand. Genesee, Jules, Shoals, and Nolin are examples of soils that formed in alluvium on flood plains.

### Climate

Precipitation and temperature have had dramatic effects on the soils in Brown County. Naturally acid rain has helped to leach carbonates out of the parent material, which was once high in content of lime. The amount of annual precipitation is high enough for several chemical compounds to be leached entirely from some of the soils. The climate in the county generally has favored the growth of hardwood forests, which affect the amount and distribution of organic matter in the soils.

### Topography

Topography influences soil formation through its effect on water relationships, erosion, landslides, and

floodwater deposits. Relief typically accounts for differences among soils that formed in the same kind of parent material. Commonly, a given set of soil characteristics is related to the slope and internal drainage. For example, Rossmoyne, Avonburg, Clermont, and Blanchester soils all formed in loess and glacial till. The wetter of these soils generally are in nearly level areas, whereas the better drained soils are in more sloping areas where runoff is more rapid. The wetter soils are grayer in the subsoil than the better drained soils.

Topography also has helped to change the characteristics of soils through its effect on erosion. For example, the sloping Lowell soils on ridgetops are near the very steep Eden soils on hillsides. Erosion continually removes material from the surface at a faster rate on the Eden soils than on the Lowell soils. As a result, the Lowell soils still have a mantle of loess and have a subsoil in which most of the limestone has weathered to soil material. In areas of the Eden soils, erosion has removed the mantle of loess and has moved the finer textured material weathered from limestone to downslope areas, leaving numerous limestone rocks on the surface.

Pate soils, which formed in colluvial material derived from upslope areas, are at the base of slopes. Soil material tends to accumulate in these landscape positions.

Flood plains are on the lowest parts of the landscape, near streams. They receive sediments when water runs off the higher adjacent areas.

### Living Organisms

Plants, animals, and micro-organisms are active factors of soil formation.

The dominant native vegetation during soil formation in Brown County was mixed hardwoods. Soils that formed under hardwoods tend to have a moderately low content of organic matter, which concentrates in the upper few inches of the soils.

Micro-organisms play an important role in decomposing organic matter. They help to prevent the accumulation of large amounts of organic matter in the soil. In addition, they change the chemical environment of the soil. In particular, they are an important catalyst in the reduction and oxidation of iron, which cause the formation of yellowish brown and grayish colors. In general, the wetter the soil, the higher the concentration of gray colors.

Human beings affect the soil by clearing forests, cultivating the land, and building structures. In many areas of the county, cultivation has mixed the upper several inches into one distinct plow layer. Tillage has caused accelerated erosion in many places. As a result, subsoil material has been tilled into the surface layer. This material is lower in content of organic matter than the original surface layer and generally is higher in content of clay.

Crawfish, worms, and insects mix the soil material. In Avonburg, Clermont, and Blanchester soils, crawfish have dug channels, some of which are as much as 10 feet deep. Topsoil commonly moves into the subsoil via these channels.

### Time

The amount of time that the other soil-forming factors have acted on the parent material is important in soil formation. Soils that formed in Illinoian glacial till are about 100,000 to 300,000 years old. Wisconsin-age loess has been deposited on these soils.

Rossmoyne, Avonburg, Clermont, and Blanchester soils, which formed mainly in glacial till, have been leached to a depth of several feet. They have been leached to a greater depth than the soils that formed in the younger till in counties a short distance to the north. This difference results entirely from variations in the length of time that the soils have been subject to leaching.

Lowell, Faywood, and Eden soils formed on very old landscapes in unglaciated areas. The age of these soils is measured in hundreds of millions of years. There has been enough time for the total weathering of limestone flagstones in the subsoil of these soils. Soils on these landscapes are generally not leached to so great a depth as soils that formed in younger glacial till, mainly because of higher rates of erosion in the unglaciated areas.

Soils on flood plains, such as Genesee, Shoals, Jules, and Nolin soils, formed in recently deposited material. Soils on terraces, such as Sardinia, Williamsburg, and Elkinsville soils, formed in older material and thus are more strongly weathered than the soils on flood plains.

## Processes of Soil Formation

The factors of soil formation control or influence soil-forming processes. The major processes are additions, losses, transfers, and alterations. Some of these processes promote the differentiation of soils, whereas others retard differentiation or obliterate existing differences. As a result of the soil-forming processes, most of the soils in Brown County have distinct horizons.

Most of the organic matter that accumulates in soils is added to the surface layer. The organic matter is generally mixed with other parts of the soil by cultivation

or animal activity. It has many chemicals, which are returned to the soil when the organic matter decomposes. Other examples of additions are applications of lime and fertilizer on farmland and the deposition of sediments on flood plains or in the lower areas.

Losses occur in soils when bases and other chemicals, including nitrates, are removed by leaching and soil material is lost through erosion. The leaching of carbonates is one of the most significant losses in the soils of Brown County.

Water carries most of the translocated material in the soils of the county. In many of the soils, clay has been transferred from the A horizon to the B horizon. Thus, the B horizon is a zone of illuviation, or gain.

Mineral compounds are transformed in most soils. As the primary silicate minerals are chemically weathered, secondary materials, mainly those of the layer-lattice silicate clays, are produced. Most of the layer-lattice clays remain in the soil profile. The transformation of mineral compounds and the illuviation of clay typically result in a B horizon that has about twice the content of clay as the parent material in which it formed. As a result of some transformations, weak cementing agents are released. These aid in the formation of a fragipan in Rossmoyne and Sciotoville soils.

# References


(1) Allan, P.F., L.E. Garland, and R. Dugan. 1963. Rating northeastern soils for their suitability for wildlife habitat. 28th North Am. Wildl. Nat. Resour. Conf., Wildl. Manage. Inst., pp. 247-261, illus.

(2) American Association of State Highway and Transportation Officials. 1982. Standard specifications for highway materials and methods of sampling and testing. Ed. 13, 2 vols., illus.

(3) American Society for Testing and Materials. 1985. Standard test method for classification of soils for engineering purposes. ASTM Stand. D 2487.

(4) Carmean, Willard H. 1967. Soil survey refinements for predicting black oak site quality in southeastern Ohio. Soil Sci. Soc. Am. Proc. 31: 805-810, illus.

(5) Carter, Homer L., and George A. Hanuschak. 1985. Ohio agricultural statistics—1984. Ohio Crop Rep. Serv., Agdex: 100/850, 58 pp., illus.

(6) Dennis, Donald D., and Thomas W. Birch. 1981. Forest statistics for Ohio—1979. U.S. Dep. Agric., For. Serv., Resour. Bull. NE-68, 79 pp., illus.

(7) Fowler, Earl D., and T.C. Green. 1936. Soil survey of Brown County, Ohio. U.S. Dep. Agric., Bur. Chem. and Soils, 55 pp., illus.

(8) Jenny, Hans. 1941. Factors of soil formation. 281 pp., illus.

(9) Morrow, Josiah, and others. 1883. The history of Brown County, Ohio. 1,011 pp., illus.

(10) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(11) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(12) United States Department of Agriculture. 1965. Silvics of forest trees of the United States. Forest Serv., U.S. Dep. Agric. Handb. 271, 762 pp., illus.

(13) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(14) United States Department of Agriculture. 1981. Land resource regions and major land resource areas of the United States. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 296, 156 pp., illus.

(15) United States Department of Agriculture. 1984. Brown Soil and Water Conservation District resources inventory. Soil Conserv. Serv. and Econ. Res. Serv., 16 pp., illus.

(16) United States Department of Commerce, Bureau of the Census. 1983. 1982 Census of agriculture, preliminary report, Brown County, Ohio. AC82-A-39-015(P), 4 pp., illus.

(17) Winters, Eric, and Roy W. Simonson. 1951. The subsoil. Adv. Agron. 3: 1-92.

# Glossary

**ABC soil.** A soil having an A, a B, and a C horizon.

**Ablation till.** Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

**AC soil.** A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep rocky slopes.

**Aeration, soil.** The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

**Aggregate, soil.** Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

**Alluvium.** Material, such as sand, silt, or clay, deposited on land by streams.

**Area reclaim** (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

**Argillic horizon.** A subsoil horizon that is characterized by an accumulation of illuvial clay.

**Association, soil.** A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

**Available water capacity (available moisture capacity).** The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

| | |
|---|---|
| Very low | 0 to 3 |
| Low | 3 to 6 |
| Moderate | 6 to 9 |
| High | 9 to 12 |
| Very high | more than 12 |

**Basal till.** Compact glacial till deposited beneath the ice.

**Base saturation.** The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

**Bedding planes.** Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

**Bedding system.** A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

**Bedrock.** The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

**Bench terrace.** A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

**Bottom land.** The normal flood plain of a stream, subject to flooding.

**Boulders.** Rock fragments larger than 2 feet (60 centimeters) in diameter.

**Calcareous soil.** A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

**California bearing ratio** (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

**Capillary water.** Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

**Catena.** A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a

result of differences in relief and drainage.

**Cation.** An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

**Cation-exchange capacity.** The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

**Channery soil.** A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

**Chiseling.** Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

**Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

**Clay film.** A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

**Claypan.** A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

**Climax vegetation.** The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

**Coarse fragments.** If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

**Coarse textured soil.** Sand or loamy sand.

**Cobblestone (or cobble).** A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

**Colluvium.** Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

**Complex slope.** Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

**Complex, soil.** A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

**Concretions.** Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

**Conservation tillage.** A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

**Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

*Loose.*—Noncoherent when dry or moist; does not hold together in a mass.

*Friable.*—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

*Firm.*—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

*Plastic.*—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

*Sticky.*—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

*Hard.*—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

*Soft.*—When dry, breaks into powder or individual grains under very slight pressure.

*Cemented.*—Hard; little affected by moistening.

**Contour stripcropping.** Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

**Control section.** The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

**Corrosive.** High risk of corrosion to uncoated steel or deterioration of concrete.

**Cover crop.** A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

**Cutbanks cave** (in tables). The walls of excavations tend to cave in or slough.

**Deferred grazing.** Postponing grazing or resting grazing land for a prescribed period.

**Dense layer** (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

**Depth, soil.** The depth to bedrock. Deep soils are more than 40 inches deep over bedrock; moderately deep soils, 20 to 40 inches; and shallow soils, 10 to 20 inches.

**Depth to rock** (in tables). Bedrock is too near the surface for the specified use.

**Diversion (or diversion terrace).** A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

**Drainage class** (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

*Excessively drained.*—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

*Somewhat excessively drained.*—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

*Well drained.*—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

*Moderately well drained.*—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

*Somewhat poorly drained.*—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

*Poorly drained.*—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

*Very poorly drained.*—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

**Drainage, surface.** Runoff, or surface flow of water, from an area.

**Eluviation.** The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

**Eolian soil material.** Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

**Erosion.** The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

*Erosion* (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

*Erosion* (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

**Excess fines** (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

**Fertility, soil.** The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper

balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

**Fibric soil material (peat).** The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

**Field moisture capacity.** The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

**Fine textured soil.** Sandy clay, silty clay, or clay.

**First bottom.** The normal flood plain of a stream, subject to frequent or occasional flooding.

**Flagstone.** A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

**Flood plain.** A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

**Foot slope.** The inclined surface at the base of a hill.

**Fragipan.** A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

**Frost action** (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

**Genesis, soil.** The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

**Glacial drift** (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

**Glacial outwash** (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

**Glacial till** (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

**Glaciofluvial deposits** (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

**Glaciolacustrine deposits.** Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

**Gleyed soil.** Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

**Grassed waterway.** A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

**Gravel.** Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

**Gravelly soil material.** Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

**Green manure crop** (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

**Ground water** (geology). Water filling all the unblocked pores of underlying material below the water table.

**Gully.** A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

**Hemic soil material (mucky peat).** Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

**Horizon, soil.** A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

*O horizon.*—An organic layer of fresh and decaying plant residue.

*A horizon.*—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

*E horizon.*—The mineral horizon in which the main

feature is loss of silicate clay, iron, aluminum, or some combination of these.

*B horizon.*—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

*C horizon.*—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

*Cr horizon.*—Soft, consolidated bedrock beneath the soil.

*R layer.*—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

**Humus.** The well decomposed, more or less stable part of the organic matter in mineral soils.

**Hydrologic soil groups.** Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

**Illuviation.** The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

**Impervious soil.** A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

**Infiltration.** The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

**Infiltration capacity.** The maximum rate at which water can infiltrate into a soil under a given set of conditions.

**Infiltration rate.** The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

**Intake rate.** The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

| | |
|---|---|
| Less than 0.2 | very low |
| 0.2 to 0.4 | low |
| 0.4 to 0.75 | moderately low |
| 0.75 to 1.25 | moderate |
| 1.25 to 1.75 | moderately high |
| 1.75 to 2.5 | high |
| More than 2.5 | very high |

**Irrigation.** Application of water to soils to assist in production of crops. Methods of irrigation are:

*Basin.*—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

*Border.*—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

*Controlled flooding.*—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

*Drip (or trickle).*—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

*Furrow.*—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

*Sprinkler.*—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

*Subirrigation.*—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

*Wild flooding.*—Water, released at high points, is allowed to flow onto an area without controlled distribution.

**Lacustrine deposit** (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

**Landslide.** The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

**Large stones** (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

**Leaching.** The removal of soluble material from soil or other material by percolating water.

**Liquid limit.** The moisture content at which the soil passes from a plastic to a liquid state.

**Loam.** Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

**Loess.** Fine grained material, dominantly of silt-sized particles, deposited by wind.

**Low strength.** The soil is not strong enough to support loads.

**Medium textured soil.** Very fine sandy loam, loam, silt loam, or silt.

**Mineral soil.** Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

**Minimum tillage.** Only the tillage essential to crop production and prevention of soil damage.

**Moderately coarse textured soil.** Coarse sandy loam, sandy loam, or fine sandy loam.

**Moderately fine textured soil.** Clay loam, sandy clay loam, or silty clay loam.

**Moraine** (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

**Morphology, soil.** The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

**Mottling, soil.** Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

**Muck.** Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

**Munsell notation.** A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

**Neutral soil.** A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

**North aspects.** North- and east-facing slopes of 355 to 95 degrees azimuth.

**Nutrient, plant.** Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

**Organic matter.** Plant and animal residue in the soil in various stages of decomposition.

**Outwash plain.** A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

**Pan.** A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

**Parent material.** The unconsolidated organic and mineral material in which soil forms.

**Ped.** An individual natural soil aggregate, such as a granule, a prism, or a block.

**Pedon.** The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

**Percolation.** The downward movement of water through the soil.

**Percs slowly** (in tables). The slow movement of water through the soil, adversely affecting the specified use.

**Perimeter drain.** A drain installed around the perimeter of a septic tank absorption field to lower the water table; also called curtain drain.

**Permeability.** The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

| | |
|---|---|
| Very slow | less than 0.06 inch |
| Slow | 0.06 to 0.2 inch |
| Moderately slow | 0.2 to 0.6 inch |
| Moderate | 0.6 inch to 2.0 inches |
| Moderately rapid | 2.0 to 6.0 inches |
| Rapid | 6.0 to 20 inches |
| Very rapid | more than 20 inches |

**Phase, soil.** A subdivision of a soil series based on

features that affect its use and management. For example, slope, stoniness, and thickness.

**pH value.** A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

**Piping** (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

**Plasticity index.** The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

**Plastic limit.** The moisture content at which a soil changes from semisolid to plastic.

**Plowpan.** A compacted layer formed in the soil directly below the plowed layer.

**Ponding.** Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

**Poorly graded.** Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

**Productivity, soil.** The capability of a soil for producing a specified plant or sequence of plants under specific management.

**Profile, soil.** A vertical section of the soil extending through all its horizons and into the parent material.

**Reaction, soil.** A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

| | |
|---|---|
| Extremely acid | below 4.5 |
| Very strongly acid | 4.5 to 5.0 |
| Strongly acid | 5.1 to 5.5 |
| Medium acid | 5.6 to 6.0 |
| Slightly acid | 6.1 to 6.5 |
| Neutral | 6.6 to 7.3 |
| Mildly alkaline | 7.4 to 7.8 |
| Moderately alkaline | 7.9 to 8.4 |
| Strongly alkaline | 8.5 to 9.0 |
| Very strongly alkaline | 9.1 and higher |

**Regolith.** The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

**Relief.** The elevations or inequalities of a land surface, considered collectively.

**Residuum (residual soil material).** Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

**Rill.** A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

**Rippable.** Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

**Rock fragments.** Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

**Rooting depth** (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

**Root zone.** The part of the soil that can be penetrated by plant roots.

**Runoff.** The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

**Sand.** As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

**Sandstone.** Sedimentary rock containing dominantly sand-sized particles.

**Sapric soil material (muck).** The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

**Sedimentary rock.** Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

**Seepage** (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

**Series, soil.** A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

**Shale.** Sedimentary rock formed by the hardening of a clay deposit.

**Sheet erosion.** The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

**Shrink-swell.** The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can

damage roads, dams, building foundations, and other structures. It can also damage plant roots.

**Silica.** A combination of silicon and oxygen. The mineral form is called quartz.

**Silt.** As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

**Siltstone.** Sedimentary rock made up of dominantly silt-sized particles.

**Similar soils.** Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

**Site index.** A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

**Slickensides.** Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

**Slippage** (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

**Slope.** The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

**Slope** (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

**Slow refill** (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

**Small stones** (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

**Soil.** A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

**Soil separates.** Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

| | |
|---|---|
| Very coarse sand | 2.0 to 1.0 |
| Coarse sand | 1.0 to 0.5 |
| Medium sand | 0.5 to 0.25 |
| Fine sand | 0.25 to 0.10 |
| Very fine sand | 0.10 to 0.05 |
| Silt | 0.05 to 0.002 |
| Clay | less than 0.002 |

**Solum.** The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

**South aspects.** South- and west-facing slopes of 96 to 354 degrees azimuth.

**Stone line.** A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

**Stones.** Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

**Stony.** Refers to a soil containing stones in numbers that interfere with or prevent tillage.

**Stripcropping.** Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

**Structure, soil.** The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

**Subsoil.** Technically, the B horizon; roughly, the part of the solum below plow depth.

**Subsoiling.** Breaking up a compact subsoil by pulling a special chisel through the soil.

**Substratum.** The part of the soil below the solum.

**Subsurface layer.** Any surface soil horizon (A, E, AB, or EB) below the surface layer.

**Surface layer.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

**Surface soil.** The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

**Taxadjuncts.** Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

**Terminal moraine.** A belt of thick glacial drift that generally marks the termination of important glacial advances.

**Terrace.** An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

**Terrace** (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

**Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

**Thin layer** (in tables). Otherwise suitable soil material too thin for the specified use.

**Till plain.** An extensive flat to undulating area underlain by glacial till.

**Tilth, soil.** The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

**Toe slope.** The outermost inclined surface at the base of a hill; part of a foot slope.

**Topsoil.** The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

**Trace elements.** Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

**Upland** (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

**Valley fill.** In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

**Variegation.** Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

**Water bar.** A shallow trench and a mound of earth constructed at an angle across a road or trail to intercept and divert runoff and reduce the hazard of erosion.

**Weathering.** All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

**Well graded.** Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

**Wilting point (or permanent wilting point).** The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

# Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1959-81 at Ripley, Ohio)

| Month | Temperature | | | | | | Precipitation | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average daily maximum | Average daily minimum | Average | 2 years in 10 will have-- Maximum temperature higher than-- | 2 years in 10 will have-- Minimum temperature lower than-- | Average number of growing degree days* | Average | 2 years in 10 will have-- Less than-- | 2 years in 10 will have-- More than-- | Average number of days with 0.10 inch or more | Average snowfall |
| | °F | °F | °F | °F | °F | Units | In | In | In | | In |
| January----- | 37.9 | 20.2 | 29.1 | 68 | -12 | 15 | 2.61 | 1.28 | 3.76 | 6 | 7.8 |
| February---- | 41.6 | 21.9 | 31.8 | 69 | -7 | 16 | 2.50 | 1.08 | 3.70 | 6 | 5.8 |
| March------- | 53.3 | 32.2 | 42.8 | 78 | 8 | 87 | 4.35 | 1.96 | 6.38 | 8 | 4.3 |
| April------- | 65.6 | 42.5 | 54.1 | 83 | 23 | 161 | 4.17 | 1.95 | 6.08 | 8 | .2 |
| May--------- | 73.8 | 50.9 | 62.4 | 90 | 30 | 392 | 4.49 | 2.59 | 6.18 | 8 | .0 |
| June-------- | 81.7 | 59.3 | 70.5 | 92 | 43 | 615 | 4.08 | 2.36 | 5.61 | 7 | .0 |
| July-------- | 84.3 | 63.1 | 73.7 | 94 | 49 | 735 | 4.69 | 3.04 | 6.19 | 8 | .0 |
| August------ | 83.4 | 61.8 | 72.6 | 94 | 47 | 701 | 4.18 | 2.41 | 5.75 | 7 | .0 |
| September--- | 78.2 | 55.5 | 66.9 | 92 | 36 | 507 | 3.46 | 1.63 | 5.02 | 6 | .0 |
| October----- | 67.2 | 43.6 | 55.4 | 85 | 23 | 214 | 2.65 | 1.24 | 3.87 | 5 | .0 |
| November---- | 53.7 | 34.8 | 44.3 | 76 | 13 | 24 | 3.13 | 1.65 | 4.42 | 7 | 1.2 |
| December---- | 42.9 | 25.8 | 34.4 | 69 | -1 | 11 | 3.11 | 1.54 | 4.47 | 7 | 3.2 |
| Yearly: | | | | | | | | | | | |
| Average--- | 63.6 | 42.6 | 53.2 | --- | --- | --- | --- | --- | --- | --- | --- |
| Extreme--- | --- | --- | --- | 96 | -13 | --- | --- | --- | --- | --- | --- |
| Total----- | --- | --- | --- | --- | --- | 3,478 | 43.42 | 38.37 | 48.40 | 83 | 22.5 |

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1959-81 at Ripley, Ohio)

| Probability | Temperature | | |
|---|---|---|---|
| | 24 °F or lower | 28 °F or lower | 32 °F or lower |
| Last freezing temperature in spring: | | | |
| 1 year in 10 later than-- | Apr. 28 | May 12 | June 2 |
| 2 years in 10 later than-- | Apr. 15 | Apr. 28 | May 17 |
| 5 years in 10 later than-- | Mar. 22 | Apr. 1 | Apr. 18 |
| First freezing temperature in fall: | | | |
| 1 year in 10 earlier than-- | Oct. 3 | Sept. 17 | Sept. 8 |
| 2 years in 10 earlier than-- | Oct. 17 | Oct. 2 | Sept. 23 |
| 5 years in 10 earlier than-- | Nov. 13 | Oct. 31 | Oct. 22 |

TABLE 3.--GROWING SEASON

(Recorded in the period 1959-81 at Ripley, Ohio)

| Probability | Daily minimum temperature during growing season | | |
|---|---|---|---|
| | Higher than 24 °F | Higher than 28 °F | Higher than 32 °F |
| | Days | Days | Days |
| 9 years in 10 | 201 | 178 | 154 |
| 8 years in 10 | 209 | 186 | 161 |
| 5 years in 10 | 224 | 200 | 173 |
| 2 years in 10 | 240 | 215 | 187 |
| 1 year in 10 | 250 | 225 | 195 |

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

| Map symbol | Soil name | Acres | Percent |
|---|---|---|---|
| Ag | Algiers silt loam, frequently flooded | 116 | * |
| AtC2 | Atlas silty clay loam, 6 to 12 percent slopes, eroded | 196 | 0.1 |
| AvA | Avonburg silt loam, 0 to 2 percent slopes | 40,142 | 12.8 |
| AwB2 | Avonburg-Atlas complex, 2 to 6 percent slopes, eroded | 4,855 | 1.5 |
| Bc | Blanchester silt loam | 5,572 | 1.8 |
| BoD2 | Bonnell silt loam, 15 to 25 percent slopes, eroded | 16,361 | 5.2 |
| BoE | Bonnell silt loam, 25 to 40 percent slopes | 4,765 | 1.5 |
| BoF | Bonnell silt loam, 40 to 60 percent slopes | 720 | 0.2 |
| BrD3 | Bonnell silty clay loam, 15 to 25 percent slopes, severely eroded | 1,969 | 0.6 |
| ChF | Chili loam, 35 to 70 percent slopes | 233 | 0.1 |
| CnC2 | Cincinnati silt loam, 6 to 12 percent slopes, eroded | 1,257 | 0.4 |
| Ct | Clermont silt loam | 67,112 | 21.5 |
| EaE | Eden flaggy silt loam, 25 to 40 percent slopes | 14,290 | 4.6 |
| EaF | Eden flaggy silt loam, 40 to 70 percent slopes | 10,576 | 3.4 |
| EkB | Elkinsville silt loam, 2 to 6 percent slopes | 1,802 | 0.6 |
| EkC2 | Elkinsville silt loam, 6 to 12 percent slopes, eroded | 433 | 0.1 |
| FdD2 | Faywood silt loam, 15 to 25 percent slopes, eroded | 9,076 | 2.9 |
| FeC2 | Faywood-Lowell silt loams, 8 to 15 percent slopes, eroded | 7,897 | 2.5 |
| Ge | Genesee silt loam, occasionally flooded | 5,982 | 1.9 |
| JeC2 | Jessup silt loam, 8 to 15 percent slopes, eroded | 3,539 | 1.1 |
| JeD2 | Jessup silt loam, 15 to 25 percent slopes, eroded | 5,438 | 1.7 |
| Ju | Jules silt loam, frequently flooded | 755 | 0.2 |
| LoB2 | Loudon silt loam, 3 to 8 percent slopes, eroded | 3,911 | 1.2 |
| LwB2 | Lowell silt loam, 3 to 8 percent slopes, eroded | 191 | 0.1 |
| No | Nolin silt loam, occasionally flooded | 2,403 | 0.8 |
| PaC2 | Pate silty clay, 8 to 15 percent slopes, eroded | 389 | 0.1 |
| PaD2 | Pate silty clay, 15 to 25 percent slopes, eroded | 906 | 0.3 |
| PaE2 | Pate silty clay, 25 to 35 percent slopes, eroded | 11,088 | 3.5 |
| RpB | Rossmoyne silt loam, 1 to 6 percent slopes | 63,683 | 20.4 |
| RpC2 | Rossmoyne silt loam, 6 to 12 percent slopes, eroded | 17,431 | 5.6 |
| RwC3 | Rossmoyne-Bonnell complex, 6 to 12 percent slopes, severely eroded | 2,645 | 0.8 |
| SaB | Sardinia silt loam, 1 to 6 percent slopes | 1,345 | 0.4 |
| ScA | Sciotoville silt loam, 0 to 2 percent slopes | 759 | 0.2 |
| Sh | Shoals silt loam, frequently flooded | 1,342 | 0.4 |
| WvB | Williamsburg silt loam, 2 to 6 percent slopes | 2,631 | 0.8 |
| | Water | 2,046 | 0.7 |
| | Total | 313,856 | 100.0 |

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

| Map symbol | Soil name |
|---|---|
| Ag | Algiers silt loam, frequently flooded (where drained and either protected from flooding or not frequently flooded during the growing season) |
| AvA | Avonburg silt loam, 0 to 2 percent slopes (where drained) |
| Bc | Blanchester silt loam (where drained) |
| EkB | Elkinsville silt loam, 2 to 6 percent slopes |
| Ge | Genesee silt loam, occasionally flooded |
| Ju | Jules silt loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season) |
| No | Nolin silt loam, occasionally flooded |
| RpB | Rossmoyne silt loam, 1 to 6 percent slopes |
| SaB | Sardinia silt loam, 1 to 6 percent slopes |
| ScA | Sciotoville silt loam, 0 to 2 percent slopes |
| Sh | Shoals silt loam, frequently flooded (where drained and either protected from flooding or not frequently flooded during the growing season) |
| WvB | Williamsburg silt loam, 2 to 6 percent slopes |

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

| Soil name and map symbol | Land capability | Corn | Soybeans | Winter wheat | Orchardgrass-alfalfa hay | Red clover-timothy hay | Tall fescue | Tobacco |
|---|---|---|---|---|---|---|---|---|
| | | Bu | Bu | Bu | Tons | Tons | AUM* | Lbs |
| Ag-----------------<br>Algiers | IIw | 110 | 35 | 40 | 4.4 | 3.5 | 7.5 | 2,200 |
| AtC2------------<br>Atlas | IIIe | 75 | 20 | 30 | 3.0 | 3.0 | 6.0 | 1,800 |
| AvA-------------<br>Avonburg | IIw | 115 | 40 | 50 | 3.6 | 3.6 | 7.2 | 2,500 |
| AwB2------------<br>Avonburg-Atlas | IIe | 95 | 32 | 40 | 3.3 | 3.4 | 6.5 | 2,100 |
| Bc--------------<br>Blanchester | IIIw | 115 | 40 | 45 | 3.2 | 4.0 | 7.0 | 2,600 |
| BoD2, BoE-------<br>Bonnell | VIe | --- | --- | --- | 3.8 | 3.0 | 6.2 | --- |
| BoF-------------<br>Bonnell | VIIe | --- | --- | --- | --- | --- | --- | --- |
| BrD3------------<br>Bonnell | VIe | --- | --- | --- | --- | --- | 3.2 | --- |
| ChF-------------<br>Chili | VIIe | --- | --- | --- | --- | --- | --- | --- |
| CnC2------------<br>Cincinnati | IIIe | 100 | 30 | 40 | 3.8 | 3.0 | 6.8 | 2,800 |
| Ct--------------<br>Clermont | IIIw | 110 | 35 | 35 | 2.9 | 3.2 | 3.4 | 2,000 |
| EaE, EaF--------<br>Eden | VIIe | --- | --- | --- | --- | 3.0 | --- | --- |
| EkB-------------<br>Elkinsville | IIe | 120 | 42 | 48 | 4.2 | 3.2 | 8.0 | 3,200 |
| EkC2------------<br>Elkinsville | IIIe | 105 | 37 | 42 | 3.8 | 3.0 | 6.8 | 2,800 |
| FdD2------------<br>Faywood | VIe | --- | --- | --- | 3.5 | 2.5 | 6.0 | --- |
| FeC2------------<br>Faywood-Lowell | IIIe | 88 | 27 | 35 | 3.7 | 2.8 | 6.3 | 2,246 |
| Ge--------------<br>Genesee | IIw | 115 | 35 | 40 | 3.8 | 3.6 | 7.0 | 2,800 |
| JeC2------------<br>Jessup | IIIe | 85 | 20 | 30 | 3.8 | 3.2 | 6.5 | 2,000 |
| JeD2------------<br>Jessup | IVe | 75 | --- | 32 | 3.5 | 2.8 | 5.8 | --- |

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

| Soil name and map symbol | Land capability | Corn | Soybeans | Winter wheat | Orchardgrass-alfalfa hay | Red clover-timothy hay | Tall fescue | Tobacco |
|---|---|---|---|---|---|---|---|---|
| | | Bu | Bu | Bu | Tons | Tons | AUM* | Lbs |
| Ju-------------- Jules | IIw | 100 | 30 | --- | 3.8 | 3.6 | 7.0 | 2,800 |
| LoB2------------ Loudon | IIe | 90 | 38 | 42 | 5.5 | 3.2 | 7.0 | 3,000 |
| LwB2------------ Lowell | IIe | 110 | 35 | 40 | 4.2 | 3.0 | 7.0 | 2,900 |
| No-------------- Nolin | IIw | 115 | 38 | --- | 3.8 | 3.6 | 7.0 | 2,700 |
| PaC2------------ Pate | IIIe | 85 | 30 | 38 | 3.6 | 3.2 | 6.8 | 2,600 |
| PaD2------------ Pate | VIe | --- | --- | --- | 3.2 | 2.9 | 6.3 | --- |
| PaE2------------ Pate | VIIe | --- | --- | --- | --- | --- | --- | --- |
| RpB------------- Rossmoyne | IIe | 115 | 35 | 40 | 3.6 | 3.6 | 5.9 | 3,200 |
| RpC2------------ Rossmoyne | IIIe | 100 | 30 | 35 | 3.4 | 3.0 | 5.5 | 2,500 |
| RwC3------------ Rossmoyne-Bonnell | IVe | 79 | 22 | 24 | 3.0 | 2.2 | 4.3 | --- |
| SaB------------- Sardinia | IIe | 115 | 40 | 45 | 4.0 | 3.2 | 7.0 | 2,500 |
| ScA------------- Sciotoville | IIw | 115 | 40 | 35 | 3.6 | 3.0 | 5.9 | 2,600 |
| Sh-------------- Shoals | IIw | 105 | 46 | 35 | 4.4 | 4.0 | 8.0 | 2,200 |
| WvB------------- Williamsburg | IIe | 115 | 40 | 45 | 4.8 | 3.5 | 7.0 | 3,200 |

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

| Class | Total acreage | Major management concerns (Subclass) | | |
|---|---|---|---|---|
| | | Erosion (e) | Wetness (w) | Soil problem (s) |
| | | Acres | Acres | Acres |
| I | --- | --- | --- | --- |
| II | 129,917 | 78,418 | 51,499 | --- |
| III | 103,826 | 31,142 | 72,684 | --- |
| IV | 8,083 | 8,083 | --- | --- |
| V | --- | --- | --- | --- |
| VI | 33,077 | 33,077 | --- | --- |
| VII | 36,907 | 36,907 | --- | --- |
| VIII | --- | --- | --- | --- |

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

| Soil name and map symbol | Ordination symbol | Management concerns: Erosion hazard | Management concerns: Equipment limitation | Management concerns: Seedling mortality | Management concerns: Windthrow hazard | Potential productivity: Common trees | Potential productivity: Site index | Potential productivity: Volume* | Trees to plant |
|---|---|---|---|---|---|---|---|---|---|
| Ag-------------- Algiers | 4A | Slight | Slight | Slight | Slight | Northern red oak---- | 76 | 58 | Eastern white pine, black cherry, white ash, yellow poplar, red pine, white oak, northern red oak, green ash, black locust, American sycamore, eastern cottonwood. |
| | | | | | | White oak----------- | --- | --- | |
| | | | | | | Yellow poplar------- | --- | --- | |
| | | | | | | White ash----------- | --- | --- | |
| | | | | | | Sugar maple--------- | --- | --- | |
| | | | | | | Black cherry-------- | --- | --- | |
| AtC2------------ Atlas | 4C | Slight | Slight | Severe | Severe | White oak----------- | 70 | 52 | Green ash, pin oak, red maple, Austrian pine. |
| | | | | | | Northern red oak---- | 70 | 52 | |
| | | | | | | Bur oak------------- | 70 | 52 | |
| | | | | | | Green ash----------- | --- | --- | |
| AvA------------- Avonburg | 4D | Slight | Slight | Slight | Moderate | White oak----------- | 70 | 52 | Eastern white pine, baldcypress, white ash, red maple, yellow poplar, American sycamore. |
| | | | | | | Northern red oak---- | 75 | 57 | |
| | | | | | | Pin oak------------- | 85 | 67 | |
| | | | | | | Yellow poplar------- | 85 | 81 | |
| | | | | | | Sweetgum------------ | 80 | 79 | |
| AwB2**: | | | | | | | | | |
| Avonburg------- | 4D | Slight | Slight | Slight | Moderate | White oak----------- | 70 | 52 | Eastern white pine, baldcypress, white ash, red maple, yellow poplar, American sycamore. |
| | | | | | | Northern red oak---- | 75 | 57 | |
| | | | | | | Pin oak------------- | 85 | 67 | |
| | | | | | | Yellow poplar------- | 85 | 81 | |
| | | | | | | Sweetgum------------ | 80 | 79 | |
| Atlas---------- | 4C | Slight | Slight | Severe | Severe | White oak----------- | 70 | 52 | Green ash, pin oak, red maple, Austrian pine. |
| | | | | | | Northern red oak---- | 70 | 52 | |
| | | | | | | Bur oak------------- | 70 | 52 | |
| | | | | | | Green ash----------- | --- | --- | |
| Bc-------------- Blanchester | 5W | Slight | Severe | Severe | Severe | Pin oak------------- | 90 | 72 | American sycamore, green ash, red maple, eastern cottonwood, pin oak, silver maple, swamp white oak, sweetgum. |
| | | | | | | Green ash----------- | --- | --- | |
| | | | | | | Black cherry-------- | --- | --- | |
| | | | | | | Eastern cottonwood-- | --- | --- | |
| | | | | | | Red maple----------- | --- | --- | |
| | | | | | | Swamp white oak----- | --- | --- | |

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

| Soil name and map symbol | Ordination symbol | Management concerns: Erosion hazard | Equipment limitation | Seedling mortality | Windthrow hazard | Potential productivity: Common trees | Site index | Volume* | Trees to plant |
|---|---|---|---|---|---|---|---|---|---|
| BoD2, BoE: Bonnell | 4R | Moderate | Moderate | Severe | Slight | Northern red oak | 76 | 58 | Yellow poplar, eastern white pine, shortleaf pine, Virginia pine, loblolly pine. |
| | | | | | | Yellow poplar | 90 | 90 | |
| | | | | | | Shortleaf pine | 80 | 130 | |
| | | | | | | Virginia pine | 80 | 122 | |
| BoF: Bonnell | 4R | Severe | Severe | Severe | Slight | Northern red oak | 76 | 58 | Yellow poplar, eastern white pine, shortleaf pine, Virginia pine, loblolly pine. |
| | | | | | | Yellow poplar | 90 | 90 | |
| | | | | | | Shortleaf pine | 80 | 130 | |
| | | | | | | Virginia pine | 80 | 122 | |
| BrD3: Bonnell | 3R | Moderate | Moderate | Severe | Slight | Northern red oak | 66 | 48 | Virginia pine, shortleaf pine, loblolly pine. |
| | | | | | | Shortleaf pine | 70 | 110 | |
| | | | | | | Virginia pine | 70 | 109 | |
| ChF: Chili | 4R | Severe | Severe | Slight | Slight | White oak | 80 | 62 | Eastern white pine, red pine, black walnut, yellow poplar, white ash, northern red oak, white oak, green ash, black cherry, black locust. |
| | | | | | | Northern red oak | 85 | 67 | |
| | | | | | | Black walnut | --- | --- | |
| | | | | | | Black cherry | --- | --- | |
| | | | | | | Sugar maple | --- | --- | |
| | | | | | | White ash | --- | --- | |
| | | | | | | Yellow poplar | --- | --- | |
| CnC2: Cincinnati | 4A | Slight | Slight | Slight | Slight | Northern red oak | 80 | 62 | Eastern white pine, black walnut, yellow poplar, white ash, red pine, northern red oak, white oak. |
| | | | | | | White oak | --- | --- | |
| | | | | | | Black walnut | --- | --- | |
| | | | | | | Black cherry | --- | --- | |
| | | | | | | Sugar maple | --- | --- | |
| | | | | | | White ash | --- | --- | |
| | | | | | | Yellow poplar | --- | --- | |
| Ct: Clermont | 5W | Slight | Severe | Severe | Severe | Pin oak | 86 | 68 | Sweetgum, baldcypress, red maple, green ash, American sycamore, eastern cottonwood, pin oak, swamp white oak. |
| | | | | | | Northern red oak | 96 | 78 | |
| | | | | | | Yellow poplar | 97 | 102 | |
| | | | | | | Sweetgum | 67 | 51 | |
| | | | | | | Green ash | --- | --- | |
| | | | | | | Black cherry | --- | --- | |
| | | | | | | Eastern cottonwood | --- | --- | |
| | | | | | | Red maple | --- | --- | |
| | | | | | | Swamp white oak | --- | --- | |

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

| Soil name and map symbol | Ordination symbol | Management concerns: Erosion hazard | Equipment limitation | Seedling mortality | Windthrow hazard | Potential productivity: Common trees | Site index | Volume* | Trees to plant |
|---|---|---|---|---|---|---|---|---|---|
| EaE------------- Eden | 4R | Moderate | Moderate | Moderate | Moderate | Black oak----------- | 68 | 50 | Northern red oak, white oak, white ash, eastern white pine. |
| | | | | | | White oak----------- | 61 | 44 | |
| | | | | | | White ash----------- | 60 | 51 | |
| | | | | | | Scarlet oak--------- | 68 | 50 | |
| | | | | | | Black walnut-------- | 74 | --- | |
| | | | | | | Eastern redcedar---- | 42 | 46 | |
| EaF------------- Eden | 4R | Severe | Severe | Moderate | Moderate | Black oak----------- | 68 | 50 | Northern red oak, white oak, white ash, eastern white pine. |
| | | | | | | White oak----------- | 61 | 44 | |
| | | | | | | White ash----------- | 60 | 51 | |
| | | | | | | Scarlet oak--------- | 68 | 50 | |
| | | | | | | Black walnut-------- | 74 | --- | |
| | | | | | | Eastern redcedar---- | 42 | 46 | |
| EkB, EkC2------- Elkinsville | 5A | Slight | Slight | Slight | Slight | White oak----------- | 90 | 72 | Eastern white pine, red pine, white ash, yellow poplar, black walnut, black locust. |
| | | | | | | Yellow poplar------- | 98 | 104 | |
| | | | | | | Sweetgum------------ | 76 | 70 | |
| FdD2------------ Faywood | 4R | Moderate | Moderate | Slight | Moderate | Northern red oak---- | 70 | 52 | White oak, eastern white pine, white ash, northern red oak. |
| | | | | | | Scarlet oak--------- | 72 | 54 | |
| | | | | | | White oak----------- | 60 | 43 | |
| | | | | | | Hickory------------- | --- | --- | |
| | | | | | | White ash----------- | --- | --- | |
| | | | | | | Chinkapin oak------- | --- | --- | |
| | | | | | | Sugar maple--------- | --- | --- | |
| | | | | | | Southern red oak---- | --- | --- | |
| FeC2**: | | | | | | | | | |
| Faywood-------- | 4D | Slight | Slight | Slight | Moderate | Northern red oak---- | 70 | 52 | White oak, eastern white pine, white ash, northern red oak. |
| | | | | | | Scarlet oak--------- | 72 | 54 | |
| | | | | | | White oak----------- | 60 | 43 | |
| | | | | | | Hickory------------- | --- | --- | |
| | | | | | | White ash----------- | --- | --- | |
| | | | | | | Chinkapin oak------- | --- | --- | |
| | | | | | | Sugar maple--------- | --- | --- | |
| | | | | | | Southern red oak---- | --- | --- | |
| Lowell--------- | 5A | Slight | Slight | Slight | Slight | Black oak----------- | 88 | 70 | White ash, eastern white pine, white oak, northern red oak, yellow poplar. |
| | | | | | | White ash----------- | 75 | 73 | |
| | | | | | | Hickory------------- | --- | --- | |
| | | | | | | Virginia pine------- | 78 | 119 | |
| | | | | | | Black locust-------- | --- | --- | |
| | | | | | | Sugar maple--------- | --- | --- | |
| | | | | | | Northern red oak---- | --- | --- | |
| Ge-------------- Genesee | 5A | Slight | Slight | Slight | Slight | White oak----------- | 90 | 72 | Eastern white pine, black walnut, yellow poplar, black locust. |
| | | | | | | Yellow poplar------- | 100 | 107 | |

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

| Soil name and map symbol | Ordination symbol | Management concerns: Erosion hazard | Equipment limitation | Seedling mortality | Windthrow hazard | Potential productivity: Common trees | Site index | Volume* | Trees to plant |
|---|---|---|---|---|---|---|---|---|---|
| JeC2: Jessup | 3C | Slight | Slight | Moderate | Severe | White oak | 65 | 48 | Austrian pine, green ash, red maple, yellow poplar, pin oak, black oak, American sycamore, eastern cottonwood. |
| | | | | | | Red maple | --- | --- | |
| | | | | | | Slippery elm | --- | --- | |
| | | | | | | Black cherry | --- | --- | |
| | | | | | | White ash | --- | --- | |
| JeD2: Jessup | 3R | Moderate | Moderate | Moderate | Severe | White oak | 65 | 48 | Austrian pine, green ash, red maple, yellow poplar, pin oak, black oak, American sycamore, eastern cottonwood. |
| | | | | | | Red maple | --- | --- | |
| | | | | | | Slippery elm | --- | --- | |
| | | | | | | Black cherry | --- | --- | |
| | | | | | | White ash | --- | --- | |
| Ju: Jules | 4A | Slight | Slight | Moderate | Slight | Northern red oak | 80 | 62 | Eastern white pine, black walnut, eastern cottonwood, green ash, yellow poplar. |
| | | | | | | White oak | --- | --- | |
| | | | | | | Black cherry | --- | --- | |
| | | | | | | Sugar maple | --- | --- | |
| | | | | | | Eastern cottonwood | --- | --- | |
| LoB2: Loudon | 4C | Slight | Slight | Moderate | Severe | White oak | 68 | 50 | Austrian pine, green ash, yellow poplar, pin oak, red maple, black oak, American sycamore, eastern cottonwood. |
| | | | | | | Red maple | --- | --- | |
| | | | | | | Slippery elm | --- | --- | |
| | | | | | | Black cherry | --- | --- | |
| | | | | | | White ash | --- | --- | |
| LwB2: Lowell | 5A | Slight | Slight | Slight | Slight | Black oak | 88 | 70 | White ash, eastern white pine, white oak, northern red oak, yellow poplar. |
| | | | | | | White ash | 75 | 73 | |
| | | | | | | Hickory | --- | --- | |
| | | | | | | Virginia pine | 78 | 119 | |
| | | | | | | Black locust | --- | --- | |
| | | | | | | Sugar maple | --- | --- | |
| | | | | | | Northern red oak | --- | --- | |
| No: Nolin | 5A | Slight | Slight | Slight | Slight | Northern red oak | 90 | 72 | Yellow poplar, eastern white pine, eastern cottonwood, white ash, cherrybark oak, sweetgum, black walnut. |
| | | | | | | Yellow poplar | 107 | 119 | |
| | | | | | | Sweetgum | 92 | 112 | |
| | | | | | | Eastern cottonwood | --- | --- | |
| | | | | | | Black walnut | --- | --- | |
| | | | | | | American sycamore | --- | --- | |
| | | | | | | River birch | --- | --- | |
| PaC2: Pate | 5C | Slight | Slight | Severe | Severe | Northern red oak | 86 | 68 | Eastern white pine, yellow poplar, black walnut, white ash, red pine. |
| | | | | | | Yellow poplar | 98 | 104 | |
| | | | | | | Virginia pine | --- | --- | |
| | | | | | | White oak | --- | --- | |
| | | | | | | Sweetgum | --- | --- | |

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

| Soil name and map symbol | Ordination symbol | Management concerns: Erosion hazard | Equipment limitation | Seedling mortality | Windthrow hazard | Potential productivity: Common trees | Site index | Volume* | Trees to plant |
|---|---|---|---|---|---|---|---|---|---|
| PaD2, PaE2------ Pate | 5R | Moderate | Moderate | Severe | Severe | Northern red oak---- | 86 | 68 | Eastern white pine, yellow poplar, black walnut, white ash, red pine. |
| | | | | | | Yellow poplar------- | 98 | 104 | |
| | | | | | | Virginia pine------- | --- | --- | |
| | | | | | | White oak----------- | --- | --- | |
| | | | | | | Sweetgum------------ | --- | --- | |
| RpB, RpC2------- Rossmoyne | 3D | Slight | Slight | Slight | Moderate | White oak----------- | 61 | 44 | White ash, Virginia pine, yellow poplar, eastern white pine, black oak. |
| | | | | | | White ash----------- | --- | --- | |
| | | | | | | Northern red oak---- | 80 | 62 | |
| | | | | | | Sugar maple--------- | --- | --- | |
| | | | | | | Slippery elm-------- | --- | --- | |
| | | | | | | American beech------ | --- | --- | |
| | | | | | | American sycamore--- | --- | --- | |
| RwC3**: | | | | | | | | | |
| Rossmoyne------ | 3D | Slight | Slight | Slight | Moderate | White oak----------- | 61 | 44 | White ash, Virginia pine, yellow poplar, eastern white pine, black oak. |
| | | | | | | White ash----------- | --- | --- | |
| | | | | | | Northern red oak---- | 80 | 62 | |
| | | | | | | Sugar maple--------- | --- | --- | |
| | | | | | | Slippery elm-------- | --- | --- | |
| | | | | | | American beech------ | --- | --- | |
| | | | | | | American sycamore--- | --- | --- | |
| Bonnell-------- | 3C | Slight | Slight | Severe | Slight | Northern red oak---- | 66 | 48 | Virginia pine, shortleaf pine, loblolly pine. |
| | | | | | | Shortleaf pine------ | 70 | 110 | |
| | | | | | | Virginia pine------- | 70 | 109 | |
| SaB------------- Sardinia | 5A | Slight | Slight | Slight | Slight | Northern red oak---- | 85 | 67 | Eastern white pine, red pine, yellow poplar, northern red oak, white oak, white ash. |
| | | | | | | Yellow poplar------- | 95 | 98 | |
| | | | | | | White oak----------- | 85 | 67 | |
| | | | | | | White ash----------- | --- | --- | |
| | | | | | | Black cherry-------- | --- | --- | |
| | | | | | | Sugar maple--------- | --- | --- | |
| ScA------------- Sciotoville | 4A | Slight | Slight | Slight | Slight | Northern red oak---- | 80 | 62 | Eastern white pine, yellow poplar, white ash, red pine, white oak, northern red oak, green ash, black cherry, black locust, American sycamore, eastern cottonwood. |
| | | | | | | Yellow poplar------- | 90 | 90 | |
| | | | | | | Sugar maple--------- | 80 | 50 | |
| | | | | | | Eastern white pine-- | 90 | 211 | |
| | | | | | | Black cherry-------- | --- | --- | |
| | | | | | | White ash----------- | --- | --- | |
| | | | | | | White oak----------- | --- | --- | |
| Sh-------------- Shoals | 5A | Slight | Slight | Moderate | Slight | Pin oak------------- | 90 | 72 | Sweetgum, red maple, swamp chestnut oak, pin oak, yellow poplar. |
| | | | | | | Sweetgum------------ | 86 | 95 | |
| | | | | | | Yellow poplar------- | 90 | 90 | |
| | | | | | | Virginia pine------- | 90 | 135 | |
| | | | | | | Eastern cottonwood-- | --- | --- | |
| | | | | | | White ash----------- | --- | --- | |

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

| Soil name and map symbol | Ordination symbol | Management concerns | | | | Potential productivity | | | Trees to plant |
|---|---|---|---|---|---|---|---|---|---|
| | | Erosion hazard | Equipment limitation | Seedling mortality | Windthrow hazard | Common trees | Site index | Volume* | |
| WvB: Williamsburg | 5A | Slight | Slight | Slight | Slight | White oak | 85 | 67 | Eastern white pine, black walnut, yellow poplar, white ash, red pine, northern red oak, white oak. |
| | | | | | | Yellow poplar | 95 | 98 | |
| | | | | | | Northern red oak | 85 | 67 | |
| | | | | | | Black walnut | --- | --- | |
| | | | | | | Black cherry | --- | --- | |
| | | | | | | Sugar maple | --- | --- | |
| | | | | | | White ash | --- | --- | |

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

| Soil name and map symbol | Trees having predicted 20-year average height, in feet, of-- <8 | 8-15 | 16-25 | 26-35 | >35 |
|---|---|---|---|---|---|
| Ag----------------- Algiers | --- | Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood. | Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn. | Norway spruce----- | Eastern white pine, pin oak. |
| AtC2-------------- Atlas | --- | American cranberrybush, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, eastern redcedar. | Osageorange, green ash, Austrian pine. | Pin oak, eastern white pine. | --- |
| AvA--------------- Avonburg | --- | Arrowwood, eastern redcedar, Washington hawthorn, Amur honeysuckle, American cranberrybush, Amur privet. | Austrian pine, green ash, Osageorange. | Eastern white pine, pin oak. | --- |
| AwB2*: | | | | | |
| Avonburg--------- | --- | Arrowwood, eastern redcedar, Washington hawthorn, Amur honeysuckle, American cranberrybush, Amur privet. | Austrian pine, green ash, Osageorange. | Eastern white pine, pin oak. | --- |
| Atlas------------ | --- | American cranberrybush, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, eastern redcedar. | Osageorange, green ash, Austrian pine. | Pin oak, eastern white pine. | --- |
| Bc---------------- Blanchester | --- | Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood. | Norway spruce, Austrian pine, northern whitecedar, blue spruce, white fir, Washington hawthorn. | Eastern white pine | Pin oak. |

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

| Soil name and map symbol | Trees having predicted 20-year average height, in feet, of-- <8 | 8-15 | 16-25 | 26-35 | >35 |
|---|---|---|---|---|---|
| BoD2, BoE, BoF, BrD3: Bonnell | --- | Eastern redcedar, Washington hawthorn, Amur honeysuckle, Amur privet, American cranberrybush, arrowwood. | Austrian pine, green ash, Osageorange. | Pin oak, eastern white pine. | --- |
| ChF. Chili | | | | | |
| CnC2: Cincinnati | --- | Eastern redcedar, Washington hawthorn, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush. | Green ash, Austrian pine, Osageorange. | Pin oak, eastern white pine. | --- |
| Ct: Clermont | --- | Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet. | Northern whitecedar, Washington hawthorn, white fir, blue spruce, Austrian pine, Norway spruce. | Eastern white pine | Pin oak. |
| EaE, EaF: Eden | --- | American cranberrybush, Amur honeysuckle, Amur privet, arrowwood, Washington hawthorn, eastern redcedar. | Hackberry, Osageorange, Austrian pine. | Pin oak, eastern white pine. | --- |
| EkB, EkC2: Elkinsville | --- | Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood. | White fir, blue spruce, northern whitecedar, Washington hawthorn. | Norway spruce, Austrian pine. | Pin oak, eastern white pine. |
| FdD2: Faywood | Siberian peashrub | Amur honeysuckle, lilac, autumn olive, Washington hawthorn, radiant crabapple, eastern redcedar. | Jack pine, Austrian pine, red pine, eastern white pine. | --- | --- |
| FeC2*: Faywood | Siberian peashrub | Amur honeysuckle, lilac, autumn olive, Washington hawthorn, radiant crabapple, eastern redcedar. | Jack pine, Austrian pine, red pine, eastern white pine. | --- | --- |

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

| Soil name and map symbol | Trees having predicted 20-year average height, in feet, of-- <8 | 8-15 | 16-25 | 26-35 | >35 |
|---|---|---|---|---|---|
| FeC2*: Lowell | --- | Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet. | Washington hawthorn, blue spruce, northern whitecedar, white fir. | Norway spruce | Austrian pine, pin oak, eastern white pine. |
| Ge Genesee | --- | Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood. | Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn. | Norway spruce | Eastern white pine, pin oak. |
| JeC2, JeD2 Jessup | --- | Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, American cranberrybush. | Austrian pine, green ash, Osageorange. | Eastern white pine, pin oak. | --- |
| Ju Jules | --- | Siberian peashrub | Green ash, Osageorange, eastern redcedar, northern whitecedar, white spruce, nannyberry viburnum, Washington hawthorn. | Black willow | --- |
| LoB2 Loudon | --- | American cranberrybush, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, eastern redcedar. | Osageorange, green ash, Austrian pine. | Eastern white pine, pin oak. | --- |
| LwB2 Lowell | --- | Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet. | Washington hawthorn, blue spruce, northern whitecedar, white fir. | Norway spruce | Austrian pine, pin oak, eastern white pine. |
| No Nolin | --- | Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet. | Washington hawthorn, blue spruce, northern whitecedar, Austrian pine. | Norway spruce | Pin oak, eastern white pine. |

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

| Soil name and map symbol | Trees having predicted 20-year average height, in feet, of-- <8 | 8-15 | 16-25 | 26-35 | >35 |
|---|---|---|---|---|---|
| PaC2, PaD2, PaE2-- Pate | --- | Eastern redcedar, Washington hawthorn, Amur honeysuckle, Amur privet, American cranberrybush, arrowwood. | Austrian pine, green ash, Osageorange. | Pin oak, eastern white pine. | --- |
| RpB, RpC2--------- Rossmoyne | --- | Washington hawthorn, Amur honeysuckle, Amur privet, eastern redcedar, American cranberrybush. | Austrian pine, Osageorange, green ash. | Pin oak, eastern white pine. | --- |
| RwC3*: | | | | | |
| Rossmoyne-------- | --- | Washington hawthorn, Amur honeysuckle, Amur privet, eastern redcedar, American cranberrybush. | Austrian pine, Osageorange, green ash. | Pin oak, eastern white pine. | --- |
| Bonnell---------- | --- | Eastern redcedar, Washington hawthorn, Amur honeysuckle, Amur privet, American cranberrybush, arrowwood. | Austrian pine, green ash, Osageorange. | Pin oak, eastern white pine. | --- |
| SaB--------------- Sardinia | --- | Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood. | Austrian pine, blue spruce, northern whitecedar, Washington hawthorn. | Norway spruce----- | Eastern white pine, pin oak. |
| ScA--------------- Sciotoville | --- | Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, American cranberrybush. | Austrian pine, green ash, Osageorange. | Eastern white pine, pin oak. | --- |
| Sh---------------- Shoals | --- | Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush. | Northern whitecedar, Austrian pine, white fir, blue spruce, Washington hawthorn. | Norway spruce----- | Eastern white pine, pin oak. |

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

| Soil name and map symbol | Trees having predicted 20-year average height, in feet, of-- | | | | |
|---|---|---|---|---|---|
| | <8 | 8-15 | 16-25 | 26-35 | >35 |
| WvB---------------- Williamsburg | --- | Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet. | Washington hawthorn, northern whitecedar, blue spruce, white fir. | Austrian pine, Norway spruce. | Pin oak, eastern white pine. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails | Golf fairways |
|---|---|---|---|---|---|
| Ag: Algiers | Severe: flooding, wetness. | Moderate: flooding, wetness. | Severe: wetness, flooding. | Moderate: flooding, wetness. | Severe: flooding. |
| AtC2: Atlas | Severe: wetness, percs slowly. | Severe: percs slowly. | Severe: slope, wetness, percs slowly. | Severe: erodes easily. | Moderate: wetness, slope. |
| AvA: Avonburg | Severe: wetness, percs slowly. | Severe: percs slowly. | Severe: wetness, percs slowly. | Moderate: wetness. | Moderate: wetness. |
| AwB2*: | | | | | |
| Avonburg | Severe: wetness, percs slowly. | Severe: percs slowly. | Severe: wetness, percs slowly. | Moderate: wetness. | Moderate: wetness. |
| Atlas | Severe: wetness, percs slowly. | Severe: percs slowly. | Severe: wetness, percs slowly. | Severe: erodes easily. | Moderate: wetness. |
| Bc: Blanchester | Severe: ponding, percs slowly. | Severe: ponding, percs slowly. | Severe: ponding, percs slowly. | Severe: ponding. | Severe: ponding. |
| BoD2: Bonnell | Severe: slope. | Severe: slope. | Severe: slope. | Severe: erodes easily. | Severe: slope. |
| BoE, BoF: Bonnell | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope, erodes easily. | Severe: slope. |
| BrD3: Bonnell | Severe: slope. | Severe: slope. | Severe: slope. | Severe: erodes easily. | Severe: slope. |
| ChF: Chili | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| CnC2: Cincinnati | Moderate: slope, percs slowly. | Moderate: slope, percs slowly. | Severe: slope. | Severe: erodes easily. | Moderate: slope. |
| Ct: Clermont | Severe: ponding, percs slowly. | Severe: ponding, percs slowly. | Severe: ponding, percs slowly. | Severe: ponding. | Severe: ponding. |
| EaE, EaF: Eden | Severe: slope. | Severe: slope. | Severe: large stones, slope, small stones. | Severe: slope. | Severe: large stones, slope. |
| EkB: Elkinsville | Slight | Slight | Moderate: slope. | Slight | Slight. |

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails | Golf fairways |
|---|---|---|---|---|---|
| EkC2------------------ Elkinsville | Moderate: slope. | Moderate: slope. | Severe: slope. | Severe: erodes easily. | Moderate: slope. |
| FdD2------------------ Faywood | Severe: slope. | Severe: slope. | Severe: slope. | Severe: erodes easily. | Severe: slope. |
| FeC2*: | | | | | |
| Faywood-------------- | Moderate: percs slowly, slope. | Moderate: slope, percs slowly. | Severe: slope. | Severe: erodes easily. | Moderate: slope, thin layer. |
| Lowell--------------- | Moderate: slope, percs slowly. | Moderate: slope, percs slowly. | Severe: slope. | Severe: erodes easily. | Moderate: slope. |
| Ge-------------------- Genesee | Severe: flooding. | Slight---------- | Moderate: flooding. | Slight---------- | Moderate: flooding. |
| JeC2------------------ Jessup | Moderate: slope, percs slowly. | Moderate: slope, percs slowly. | Severe: slope. | Severe: erodes easily. | Moderate: slope. |
| JeD2------------------ Jessup | Severe: slope. | Severe: slope. | Severe: slope. | Severe: erodes easily. | Severe: slope. |
| Ju-------------------- Jules | Severe: flooding. | Moderate: flooding. | Severe: flooding. | Moderate: flooding. | Severe: flooding. |
| LoB2------------------ Loudon | Moderate: wetness, percs slowly. | Moderate: wetness, percs slowly. | Moderate: slope, wetness, percs slowly. | Moderate: wetness. | Slight. |
| LwB2------------------ Lowell | Moderate: percs slowly. | Moderate: percs slowly. | Moderate: slope, percs slowly. | Slight---------- | Slight. |
| No-------------------- Nolin | Severe: flooding. | Slight---------- | Moderate: flooding. | Slight---------- | Moderate: flooding. |
| PaC2------------------ Pate | Severe: percs slowly, too clayey. | Severe: too clayey, percs slowly. | Severe: slope, too clayey, percs slowly. | Severe: too clayey. | Severe: too clayey. |
| PaD2------------------ Pate | Severe: slope, percs slowly, too clayey. | Severe: slope, too clayey, percs slowly. | Severe: slope, too clayey, percs slowly. | Severe: too clayey. | Severe: slope, too clayey. |
| PaE2------------------ Pate | Severe: slope, percs slowly, too clayey. | Severe: slope, too clayey, percs slowly. | Severe: slope, too clayey, percs slowly. | Severe: too clayey, slope. | Severe: slope, too clayey. |
| RpB------------------- Rossmoyne | Moderate: wetness, percs slowly. | Moderate: wetness, percs slowly. | Moderate: slope, wetness, percs slowly. | Moderate: wetness. | Moderate: wetness. |

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails | Golf fairways |
|---|---|---|---|---|---|
| RpC2------------------ Rossmoyne | Moderate: slope, wetness, percs slowly. | Moderate: slope, wetness, percs slowly. | Severe: slope. | Severe: erodes easily. | Moderate: wetness, slope. |
| RwC3*: | | | | | |
| Rossmoyne------------ | Moderate: slope, wetness, percs slowly. | Moderate: slope, wetness, percs slowly. | Severe: slope. | Severe: erodes easily. | Moderate: wetness, slope. |
| Bonnell-------------- | Moderate: slope, percs slowly. | Moderate: slope, percs slowly. | Severe: slope. | Severe: erodes easily. | Moderate: slope. |
| SaB------------------- Sardinia | Moderate: wetness. | Moderate: wetness. | Moderate: slope, small stones, wetness. | Moderate: wetness. | Moderate: wetness. |
| ScA------------------- Sciotoville | Moderate: wetness. | Moderate: wetness, percs slowly. | Moderate: wetness, percs slowly. | Slight---------- | Moderate: wetness. |
| Sh-------------------- Shoals | Severe: flooding, wetness. | Severe: wetness. | Severe: wetness, flooding. | Severe: wetness. | Severe: wetness, flooding. |
| WvB------------------- Williamsburg | Slight---------- | Slight---------- | Moderate: slope. | Slight---------- | Slight. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

| Soil name and map symbol | Potential for habitat elements: Grain and seed crops | Grasses and legumes | Wild herbaceous plants | Hardwood trees | Coniferous plants | Wetland plants | Shallow water areas | Potential as habitat for--: Openland wildlife | Woodland wildlife | Wetland wildlife |
|---|---|---|---|---|---|---|---|---|---|---|
| Ag: Algiers | Fair | Good | Good | Good | Good | Fair | Fair | Good | Good | Fair. |
| AtC2: Atlas | Fair | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| AvA: Avonburg | Fair | Good | Good | Good | Good | Fair | Fair | Good | Good | Fair. |
| AwB2*: | | | | | | | | | | |
| Avonburg | Fair | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| Atlas | Fair | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| Bc: Blanchester | Poor | Fair | Fair | Fair | Fair | Good | Good | Fair | Fair | Good. |
| BoD2: Bonnell | Poor | Fair | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| BoE: Bonnell | Very poor. | Fair | Good | Good | Good | Very poor. | Very poor. | Fair | Good | Very poor. |
| BoF: Bonnell | Very poor. | Very poor. | Good | Good | Good | Very poor. | Very poor. | Very poor. | Good | Very poor. |
| BrD3: Bonnell | Poor | Fair | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| ChF: Chili | Very poor. | Poor | Good | Good | Good | Poor | Very poor. | Poor | Good | Very poor. |
| CnC2: Cincinnati | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| Ct: Clermont | Fair | Fair | Good | Fair | Fair | Good | Good | Fair | Fair | Good. |
| EaE: Eden | Very poor. | Fair | Fair | Fair | Fair | Very poor. | Very poor. | Poor | Fair | Very poor. |
| EaF: Eden | Very poor. | Poor | Fair | Fair | Fair | Very poor. | Very poor. | Poor | Fair | Very poor. |
| EkB: Elkinsville | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| EkC2: Elkinsville | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| FdD2: Faywood | Poor | Poor | Good | Good | Good | Very poor. | Very poor. | Fair | Good | Very poor. |

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

| Soil name and map symbol | Potential for habitat elements: Grain and seed crops | Grasses and legumes | Wild herbaceous plants | Hardwood trees | Coniferous plants | Wetland plants | Shallow water areas | Potential as habitat for--: Openland wildlife | Woodland wildlife | Wetland wildlife |
|---|---|---|---|---|---|---|---|---|---|---|
| FeC2*: | | | | | | | | | | |
| Faywood | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| Lowell | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| Ge Genesee | Good | Good | Good | Good | Good | Poor | Poor | Good | Good | Poor. |
| JeC2 Jessup | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| JeD2 Jessup | Poor | Fair | Good | Good | Good | Very poor. | Very poor. | Fair | Good | Very poor. |
| Ju Jules | Good | Good | Good | Good | Good | Poor | Poor | Good | Good | Poor. |
| LoB2 Loudon | Fair | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| LwB2 Lowell | Fair | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| No Nolin | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| PaC2 Pate | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| PaD2 Pate | Poor | Fair | Good | Good | Good | Very poor. | Very poor. | Fair | Good | Very poor. |
| PaE2 Pate | Poor | Fair | Good | Good | Good | Very poor. | Very poor. | Fair | Good | Very poor. |
| RpB Rossmoyne | Fair | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| RpC2 Rossmoyne | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| RwC3*: | | | | | | | | | | |
| Rossmoyne | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| Bonnell | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| SaB Sardinia | Fair | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| ScA Sciotoville | Good | Good | Good | Good | Good | Poor | Poor | Good | Good | Poor. |
| Sh Shoals | Poor | Fair | Fair | Good | Good | Fair | Fair | Fair | Good | Fair. |

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

| Soil name and map symbol | Potential for habitat elements | | | | | | | Potential as habitat for-- | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herba-ceous plants | Hardwood trees | Conif-erous plants | Wetland plants | Shallow water areas | Openland wildlife | Woodland wildlife | Wetland wildlife |
| WvB----------------- Williamsburg | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| Ag----------------- Algiers | Severe: cutbanks cave, wetness. | Severe: flooding, wetness. | Severe: flooding, wetness. | Severe: flooding, wetness. | Severe: low strength, flooding, frost action. | Severe: flooding. |
| AtC2-------------- Atlas | Severe: wetness. | Severe: wetness, shrink-swell. | Severe: wetness, shrink-swell. | Severe: wetness, shrink-swell, slope. | Severe: shrink-swell, low strength. | Moderate: wetness, slope. |
| AvA---------------- Avonburg | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: low strength, frost action. | Moderate: wetness. |
| AwB2*: | | | | | | |
| Avonburg--------- | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: low strength, frost action. | Moderate: wetness. |
| Atlas------------ | Severe: wetness. | Severe: wetness, shrink-swell. | Severe: wetness, shrink-swell. | Severe: wetness, shrink-swell. | Severe: shrink-swell, low strength. | Moderate: wetness. |
| Bc----------------- Blanchester | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: low strength, ponding, frost action. | Severe: ponding. |
| BoD2, BoE, BoF, BrD3-------------- Bonnell | Severe: slope. | Severe: shrink-swell, slope. | Severe: slope, shrink-swell. | Severe: shrink-swell, slope. | Severe: low strength, slope, shrink-swell. | Severe: slope. |
| ChF---------------- Chili | Severe: cutbanks cave, slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| CnC2-------------- Cincinnati | Moderate: dense layer, wetness, slope. | Moderate: slope. | Moderate: wetness, slope. | Severe: slope. | Severe: low strength, frost action. | Moderate: slope. |
| Ct----------------- Clermont | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: low strength, ponding, frost action. | Severe: ponding. |
| EaE, EaF----------- Eden | Severe: slope, slippage. | Severe: slope, slippage. | Severe: slope, slippage. | Severe: slope, slippage. | Severe: low strength, slope. | Severe: large stones, slope. |
| EkB---------------- Elkinsville | Slight--------- | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell, slope. | Severe: low strength, frost action. | Slight. |

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| EkC2: Elkinsville | Moderate: slope. | Moderate: shrink-swell, slope. | Moderate: slope, shrink-swell. | Severe: slope. | Severe: low strength, frost action. | Moderate: slope. |
| FdD2: Faywood | Severe: slope, depth to rock. | Severe: slope. | Severe: slope, depth to rock. | Severe: slope. | Severe: slope, low strength. | Severe: slope. |
| FeC2*: | | | | | | |
| Faywood | Severe: depth to rock. | Moderate: slope, depth to rock, shrink-swell. | Severe: depth to rock. | Severe: slope. | Severe: low strength. | Moderate: slope, thin layer. |
| Lowell | Moderate: depth to rock, too clayey, slope. | Moderate: shrink-swell, slope. | Moderate: depth to rock, slope, shrink-swell. | Severe: slope. | Severe: low strength. | Moderate: slope. |
| Ge: Genesee | Moderate: flooding. | Severe: flooding. | Severe: flooding. | Severe: flooding. | Severe: flooding. | Moderate: flooding. |
| JeC2: Jessup | Moderate: too clayey, slope. | Moderate: shrink-swell, slope. | Moderate: slope, shrink-swell. | Severe: slope. | Severe: low strength. | Moderate: slope. |
| JeD2: Jessup | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: low strength, slope. | Severe: slope. |
| Ju: Jules | Moderate: flooding. | Severe: flooding. | Severe: flooding. | Severe: flooding. | Severe: flooding, frost action. | Severe: flooding. |
| LoB2: Loudon | Severe: wetness. | Moderate: wetness, shrink-swell. | Severe: wetness. | Moderate: wetness, shrink-swell, slope. | Severe: low strength, frost action. | Slight. |
| LwB2: Lowell | Moderate: depth to rock, too clayey. | Moderate: shrink-swell. | Moderate: depth to rock, shrink-swell. | Moderate: shrink-swell, slope. | Severe: low strength. | Slight. |
| No: Nolin | Moderate: wetness, flooding. | Severe: flooding. | Severe: flooding. | Severe: flooding. | Severe: low strength, flooding, frost action. | Moderate: flooding. |
| PaC2: Pate | Moderate: too clayey, slope. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell, slope, slippage. | Severe: shrink-swell, low strength. | Severe: too clayey. |
| PaD2, PaE2: Pate | Severe: slope, slippage. | Severe: shrink-swell, slope, slippage. | Severe: slope, shrink-swell, slippage. | Severe: shrink-swell, slope, slippage. | Severe: shrink-swell, low strength, slope. | Severe: slope, too clayey. |
| RpB: Rossmoyne | Severe: wetness. | Moderate: wetness, shrink-swell. | Severe: wetness. | Moderate: wetness, shrink-swell. | Severe: low strength, frost action. | Moderate: wetness. |

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| RpC2: Rossmoyne | Severe: wetness. | Moderate: wetness, shrink-swell, slope. | Severe: wetness. | Severe: slope. | Severe: low strength, frost action. | Moderate: wetness, slope. |
| RwC3*: | | | | | | |
| Rossmoyne | Severe: wetness. | Moderate: wetness, shrink-swell, slope. | Severe: wetness. | Severe: slope. | Severe: low strength, frost action. | Moderate: wetness, slope. |
| Bonnell | Moderate: too clayey, slope. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell, slope. | Severe: low strength, shrink-swell. | Moderate: slope. |
| SaB: Sardinia | Severe: wetness. | Moderate: wetness, shrink-swell. | Severe: wetness. | Moderate: wetness, shrink-swell. | Severe: low strength, frost action. | Moderate: wetness. |
| ScA: Sciotoville | Severe: wetness. | Moderate: wetness. | Severe: wetness. | Moderate: wetness. | Severe: frost action. | Moderate: wetness. |
| Sh: Shoals | Severe: wetness. | Severe: flooding, wetness. | Severe: flooding, wetness. | Severe: flooding, wetness. | Severe: wetness, flooding, frost action. | Severe: wetness, flooding. |
| WvB: Williamsburg | Slight | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell, slope. | Severe: low strength. | Slight. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| Ag: Algiers | Severe: flooding, wetness. | Severe: seepage, flooding, wetness. | Severe: flooding, seepage, wetness. | Severe: flooding, wetness. | Poor: wetness. |
| AtC2: Atlas | Severe: wetness, percs slowly. | Severe: slope. | Severe: wetness, too clayey. | Severe: wetness. | Poor: too clayey, hard to pack. |
| AvA: Avonburg | Severe: wetness, percs slowly. | Slight | Severe: wetness. | Severe: wetness. | Poor: wetness. |
| AwB2*: | | | | | |
| Avonburg | Severe: wetness, percs slowly. | Moderate: slope. | Severe: wetness. | Severe: wetness. | Poor: wetness. |
| Atlas | Severe: wetness, percs slowly. | Moderate: slope. | Severe: wetness, too clayey. | Severe: wetness. | Poor: too clayey, hard to pack. |
| Bc: Blanchester | Severe: ponding, percs slowly. | Slight | Severe: ponding, too clayey. | Severe: ponding. | Poor: too clayey, hard to pack, ponding. |
| BoD2, BoE, BoF, BrD3: Bonnell | Severe: percs slowly, slope. | Severe: slope. | Severe: slope, too clayey. | Severe: slope. | Poor: too clayey, hard to pack, slope. |
| ChF: Chili | Severe: slope. | Severe: seepage, slope. | Severe: seepage, slope. | Severe: seepage, slope. | Poor: slope. |
| CnC2: Cincinnati | Severe: wetness, percs slowly. | Severe: slope. | Moderate: wetness, slope, too clayey. | Moderate: wetness, slope. | Fair: too clayey, slope, wetness. |
| Ct: Clermont | Severe: ponding, percs slowly. | Slight | Severe: ponding, too clayey. | Severe: ponding. | Poor: ponding, too clayey. |
| EaE, EaF: Eden | Severe: depth to rock, slope, slippage. | Severe: depth to rock, slope, slippage. | Severe: depth to rock, slope, too clayey. | Severe: depth to rock, slope, slippage. | Poor: depth to rock, too clayey, slope. |
| EkB: Elkinsville | Slight | Moderate: seepage, slope. | Moderate: too clayey. | Slight | Fair: too clayey. |

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| EkC2: Elkinsville | Moderate: slope. | Severe: slope. | Moderate: slope, too clayey. | Moderate: slope. | Fair: too clayey, slope. |
| FdD2: Faywood | Severe: slope, depth to rock, percs slowly. | Severe: slope, depth to rock. | Severe: slope, depth to rock, too clayey. | Severe: slope, depth to rock. | Poor: area reclaim, too clayey, hard to pack. |
| FeC2*: | | | | | |
| Faywood | Severe: depth to rock, percs slowly. | Severe: slope, depth to rock. | Severe: depth to rock, too clayey. | Severe: depth to rock. | Poor: area reclaim, too clayey, hard to pack. |
| Lowell | Severe: percs slowly. | Severe: slope. | Severe: depth to rock, too clayey. | Moderate: depth to rock, slope. | Poor: too clayey, hard to pack. |
| Ge: Genesee | Severe: flooding. | Severe: flooding. | Severe: flooding. | Severe: flooding. | Good. |
| JeC2: Jessup | Severe: percs slowly. | Severe: slope. | Severe: depth to rock, too clayey. | Moderate: depth to rock, slope. | Poor: too clayey, hard to pack. |
| JeD2: Jessup | Severe: percs slowly, slope. | Severe: slope. | Severe: depth to rock, slope, too clayey. | Severe: slope. | Poor: too clayey, hard to pack, slope. |
| Ju: Jules | Severe: flooding. | Severe: flooding. | Severe: flooding. | Severe: flooding. | Good. |
| LoB2: Loudon | Severe: wetness, percs slowly. | Moderate: slope. | Severe: seepage, too clayey. | Moderate: wetness. | Poor: too clayey, hard to pack. |
| LwB2: Lowell | Severe: percs slowly. | Moderate: seepage, depth to rock, slope. | Severe: depth to rock, too clayey. | Moderate: depth to rock. | Poor: too clayey, hard to pack. |
| No: Nolin | Severe: flooding. | Severe: flooding, wetness. | Severe: flooding, wetness. | Severe: flooding, wetness. | Fair: too clayey. |
| PaC2: Pate | Severe: percs slowly. | Severe: slope. | Severe: seepage, too clayey. | Moderate: slope. | Poor: too clayey, hard to pack. |
| PaD2, PaE2: Pate | Severe: percs slowly, slope, slippage. | Severe: slope, slippage. | Severe: seepage, slope, too clayey. | Severe: slope, slippage. | Poor: too clayey, hard to pack, slope. |
| RpB: Rossmoyne | Severe: wetness, percs slowly. | Moderate: slope. | Severe: wetness. | Moderate: wetness. | Fair: too clayey, wetness. |

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| RpC2: Rossmoyne | Severe: wetness, percs slowly. | Severe: slope. | Severe: wetness. | Moderate: wetness, slope. | Fair: too clayey, slope, wetness. |
| RwC3*: | | | | | |
| Rossmoyne | Severe: wetness, percs slowly. | Severe: slope. | Severe: wetness. | Moderate: wetness, slope. | Fair: too clayey, slope, wetness. |
| Bonnell | Severe: percs slowly. | Severe: slope. | Severe: too clayey. | Moderate: slope. | Poor: too clayey, hard to pack. |
| SaB: Sardinia | Severe: wetness. | Severe: wetness. | Severe: seepage, wetness. | Moderate: wetness. | Fair: too clayey, wetness. |
| ScA: Sciotoville | Severe: wetness, percs slowly. | Severe: seepage, wetness. | Severe: seepage, wetness. | Moderate: wetness. | Fair: too clayey, wetness. |
| Sh: Shoals | Severe: flooding, wetness. | Severe: flooding, wetness. | Severe: flooding, wetness. | Severe: flooding, wetness. | Poor: wetness. |
| WvB: Williamsburg | Slight | Severe: seepage. | Severe: seepage. | Slight | Fair: too clayey. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| Ag: Algiers | Fair: wetness. | Improbable: excess fines. | Improbable: excess fines. | Fair: small stones. |
| AtC2: Atlas | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| AvA: Avonburg | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Fair: area reclaim. |
| AwB2*: | | | | |
| Avonburg | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Fair: area reclaim. |
| Atlas | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| Bc: Blanchester | Poor: low strength, wetness. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer, wetness. |
| BoD2: Bonnell | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer, slope. |
| BoE, BoF: Bonnell | Poor: low strength, slope. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer, slope. |
| BrD3: Bonnell | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer, slope. |
| ChF: Chili | Poor: slope. | Probable | Probable | Poor: small stones, area reclaim, slope. |
| CnC2: Cincinnati | Fair: shrink-swell, low strength. | Improbable: excess fines. | Improbable: excess fines. | Fair: area reclaim, small stones, slope. |
| Ct: Clermont | Poor: low strength, wetness. | Improbable: excess fines. | Improbable: excess fines. | Poor: wetness. |
| EaE, EaF: Eden | Poor: depth to rock, slope. | Improbable: excess fines. | Improbable: excess fines. | Poor: large stones. |
| EkB: Elkinsville | Good | Improbable: excess fines. | Improbable: excess fines. | Good. |
| EkC2: Elkinsville | Good | Improbable: excess fines. | Improbable: excess fines. | Fair: slope. |

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| FdD2: Faywood | Poor: area reclaim, low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: slope, thin layer, too clayey. |
| FeC2*: | | | | |
| Faywood | Poor: area reclaim, low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer, too clayey. |
| Lowell | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer. |
| Ge: Genesee | Good | Improbable: excess fines. | Improbable: excess fines. | Good. |
| JeC2: Jessup | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| JeD2: Jessup | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey, slope. |
| Ju: Jules | Fair: low strength. | Improbable: excess fines. | Improbable: excess fines. | Good. |
| LoB2: Loudon | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer. |
| LwB2: Lowell | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer. |
| No: Nolin | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Good. |
| PaC2: Pate | Poor: shrink-swell, low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey, area reclaim. |
| PaD2: Pate | Poor: shrink-swell, low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey, area reclaim, slope. |
| PaE2: Pate | Poor: shrink-swell, low strength, slope. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey, area reclaim, slope. |
| RpB: Rossmoyne | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Fair: area reclaim. |
| RpC2: Rossmoyne | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Fair: area reclaim, slope. |
| RwC3*: | | | | |
| Rossmoyne | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Fair: area reclaim, slope. |

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| RwC3*: | | | | |
| Bonnell | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer. |
| SaB Sardinia | Fair: wetness. | Improbable: excess fines. | Improbable: excess fines. | Fair: small stones. |
| ScA Sciotoville | Fair: wetness. | Improbable: excess fines. | Improbable: excess fines. | Fair: small stones. |
| Sh Shoals | Poor: wetness. | Improbable: excess fines. | Improbable: excess fines. | Poor: wetness. |
| WvB Williamsburg | Good | Improbable: excess fines. | Improbable: excess fines. | Fair: too clayey, small stones. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

| Soil name and map symbol | Limitations for-- Pond reservoir areas | Embankments, dikes, and levees | Aquifer-fed excavated ponds | Features affecting-- Drainage | Terraces and diversions | Grassed waterways |
|---|---|---|---|---|---|---|
| Ag: Algiers | Severe: seepage. | Severe: piping, wetness. | Severe: cutbanks cave. | Flooding, frost action. | Erodes easily, wetness. | Wetness, erodes easily. |
| AtC2: Atlas | Severe: slope. | Severe: hard to pack. | Severe: no water. | Percs slowly, frost action, slope. | Slope, erodes easily, wetness. | Wetness, slope, erodes easily. |
| AvA: Avonburg | Moderate: seepage. | Moderate: piping, wetness. | Severe: no water. | Percs slowly, frost action. | Erodes easily, wetness, rooting depth. | Wetness, erodes easily, rooting depth. |
| AwB2*: | | | | | | |
| Avonburg | Moderate: seepage, slope. | Moderate: piping, wetness. | Severe: no water. | Percs slowly, frost action, slope. | Erodes easily, wetness, rooting depth. | Wetness, erodes easily, rooting depth. |
| Atlas | Moderate: slope. | Severe: hard to pack. | Severe: no water. | Percs slowly, frost action, slope. | Erodes easily, wetness. | Wetness, erodes easily. |
| Bc: Blanchester | Slight | Severe: hard to pack, ponding. | Severe: slow refill. | Ponding, percs slowly, frost action. | Erodes easily, ponding, percs slowly. | Wetness, erodes easily, percs slowly. |
| BoD2, BoE, BoF, BrD3: Bonnell | Severe: slope. | Moderate: hard to pack. | Severe: no water. | Deep to water | Slope, erodes easily, percs slowly. | Slope, erodes easily, percs slowly. |
| ChF: Chili | Severe: seepage, slope. | Severe: piping. | Severe: no water. | Deep to water | Slope | Slope, droughty. |
| CnC2: Cincinnati | Severe: slope. | Severe: thin layer. | Severe: no water. | Percs slowly, frost action, slope. | Slope, erodes easily, wetness. | Slope, erodes easily, rooting depth. |
| Ct: Clermont | Slight | Severe: ponding. | Severe: slow refill. | Ponding, percs slowly, frost action. | Erodes easily, ponding, percs slowly. | Wetness, erodes easily, percs slowly. |
| EaE, EaF: Eden | Severe: slope, slippage. | Severe: hard to pack, large stones. | Severe: no water. | Deep to water | Slope, large stones, depth to rock, slippage. | Large stones, slope, depth to rock. |
| EkB: Elkinsville | Moderate: seepage, slope. | Moderate: thin layer, piping. | Severe: no water. | Deep to water | Erodes easily | Erodes easily. |
| EkC2: Elkinsville | Severe: slope. | Moderate: thin layer, piping. | Severe: no water. | Deep to water | Slope, erodes easily. | Slope, erodes easily. |

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

| Soil name and map symbol | Limitations for-- Pond reservoir areas | Embankments, dikes, and levees | Aquifer-fed excavated ponds | Features affecting-- Drainage | Terraces and diversions | Grassed waterways |
|---|---|---|---|---|---|---|
| FdD2: Faywood | Severe: slope. | Severe: thin layer, hard to pack. | Severe: no water. | Deep to water | Slope, depth to rock, erodes easily. | Slope, erodes easily, depth to rock. |
| FeC2*: | | | | | | |
| Faywood | Moderate: depth to rock. | Severe: thin layer, hard to pack. | Severe: no water. | Deep to water | Slope, depth to rock, erodes easily. | Slope, erodes easily, depth to rock. |
| Lowell | Moderate: depth to rock. | Severe: hard to pack. | Severe: no water. | Deep to water | Slope, erodes easily. | Slope, erodes easily. |
| Ge: Genesee | Moderate: seepage. | Severe: piping. | Severe: no water. | Deep to water | Erodes easily | Erodes easily. |
| JeC2, JeD2: Jessup | Severe: slope. | Moderate: thin layer, hard to pack. | Severe: no water. | Deep to water | Slope, erodes easily, percs slowly. | Slope, erodes easily, percs slowly. |
| Ju: Jules | Moderate: seepage. | Severe: piping. | Severe: no water. | Deep to water | Erodes easily | Erodes easily. |
| LoB2: Loudon | Moderate: seepage, slope. | Moderate: thin layer, hard to pack, wetness. | Severe: no water. | Percs slowly, frost action, slope. | Erodes easily, wetness. | Erodes easily, rooting depth. |
| LwB2: Lowell | Moderate: depth to rock. | Severe: hard to pack. | Severe: no water. | Deep to water | Erodes easily | Erodes easily. |
| No: Nolin | Severe: seepage. | Severe: piping. | Moderate: deep to water, slow refill. | Deep to water | Erodes easily | Erodes easily. |
| PaC2: Pate | Severe: slope. | Moderate: hard to pack. | Severe: no water. | Deep to water | Slope, erodes easily, percs slowly. | Slope, erodes easily, droughty. |
| PaD2, PaE2: Pate | Severe: slope, slippage. | Moderate: hard to pack. | Severe: no water. | Deep to water | Slope, erodes easily, percs slowly, slippage. | Slope, erodes easily, droughty. |
| RpB: Rossmoyne | Moderate: seepage, slope. | Moderate: piping, wetness. | Severe: no water. | Percs slowly, frost action, slope. | Erodes easily, wetness. | Erodes easily, rooting depth. |
| RpC2: Rossmoyne | Severe: slope. | Moderate: piping, wetness. | Severe: no water. | Percs slowly, frost action, slope. | Slope, erodes easily, wetness. | Slope, erodes easily, rooting depth. |
| RwC3*: | | | | | | |
| Rossmoyne | Severe: slope. | Moderate: piping, wetness. | Severe: no water. | Percs slowly, frost action, slope. | Slope, erodes easily, wetness. | Slope, erodes easily, rooting depth. |
| Bonnell | Severe: slope. | Moderate: hard to pack. | Severe: no water. | Deep to water | Slope, erodes easily, percs slowly. | Slope, erodes easily, percs slowly. |

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

| Soil name and map symbol | Limitations for-- Pond reservoir areas | Embankments, dikes, and levees | Aquifer-fed excavated ponds | Features affecting-- Drainage | Terraces and diversions | Grassed waterways |
|---|---|---|---|---|---|---|
| SaB: Sardinia | Moderate: seepage, slope. | Moderate: piping, wetness. | Severe: no water. | Frost action, slope. | Erodes easily, wetness. | Erodes easily. |
| ScA: Sciotoville | Moderate: seepage. | Severe: piping. | Severe: no water. | Percs slowly, frost action. | Erodes easily, wetness. | Erodes easily, rooting depth. |
| Sh: Shoals | Moderate: seepage. | Severe: piping, wetness. | Moderate: slow refill. | Flooding, frost action. | Erodes easily, wetness. | Wetness, erodes easily. |
| WvB: Williamsburg | Severe: seepage. | Moderate: thin layer. | Severe: no water. | Deep to water | Erodes easily | Erodes easily. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

| Soil name and map symbol | Depth | USDA texture | Classification: Unified | Classification: AASHTO | Fragments > 3 inches | Percentage passing sieve number-- 4 | 10 | 40 | 200 | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | | | | Pct | | | | | Pct | |
| Ag------------- Algiers | 0-5 | Silt loam-------- | ML | A-4 | 0 | 100 | 90-100 | 80-95 | 70-85 | 30-40 | 4-10 |
| | 5-49 | Silty clay loam, silt loam, loam. | CL, ML | A-6, A-7, A-4 | 0 | 100 | 90-100 | 80-95 | 70-85 | 30-45 | 7-19 |
| | 49-60 | Silty clay loam, sandy loam. | GM, SM | A-1, A-2 | 0 | 50-100 | 40-85 | 35-50 | 15-35 | --- | NP |
| AtC2------------- Atlas | 0-6 | Silty clay loam | CH, CL | A-7 | 0 | 100 | 100 | 95-100 | 75-100 | 40-60 | 25-40 |
| | 6-58 | Silty clay loam, silty clay, clay loam. | CH | A-7 | 0 | 100 | 95-100 | 95-100 | 75-95 | 50-70 | 30-45 |
| | 58-80 | Clay loam, clay | CH, CL | A-6, A-7 | 0 | 95-100 | 90-100 | 90-100 | 65-95 | 35-55 | 20-30 |
| AvA-------------- Avonburg | 0-8 | Silt loam-------- | CL, ML, CL-ML | A-4 | 0 | 100 | 100 | 95-100 | 75-95 | 20-30 | 2-10 |
| | 8-29 | Silty clay loam, silt loam. | CL | A-6, A-7 | 0 | 100 | 100 | 95-100 | 75-95 | 30-45 | 10-20 |
| | 29-45 | Silty clay loam, clay loam, loam. | CL | A-6, A-7 | 0-3 | 95-100 | 95-100 | 90-100 | 70-95 | 30-45 | 10-20 |
| | 45-80 | Clay loam, loam | CL | A-6, A-7 | 0-3 | 95-100 | 90-100 | 75-95 | 60-85 | 30-45 | 10-20 |
| AwB2*: | | | | | | | | | | | |
| Avonburg-------- | 0-6 | Silt loam-------- | CL, ML, CL-ML | A-4 | 0 | 100 | 100 | 95-100 | 75-95 | 20-30 | 2-10 |
| | 6-31 | Silty clay loam, silt loam. | CL | A-6, A-7 | 0 | 100 | 100 | 95-100 | 75-95 | 30-45 | 10-20 |
| | 31-80 | Clay loam, loam | CL | A-6, A-7 | 0-3 | 95-100 | 90-100 | 75-95 | 60-85 | 30-45 | 10-20 |
| Atlas----------- | 0-6 | Silty clay loam | CH, CL | A-7 | 0 | 100 | 100 | 95-100 | 75-100 | 40-60 | 25-40 |
| | 6-58 | Silty clay loam, silty clay, clay loam. | CH | A-7 | 0 | 100 | 95-100 | 95-100 | 75-95 | 50-70 | 30-45 |
| | 58-80 | Clay loam, clay | CH, CL | A-6, A-7 | 0 | 95-100 | 90-100 | 90-100 | 65-95 | 35-55 | 20-30 |
| Bc--------------- Blanchester | 0-8 | Silt loam-------- | CL, CL-ML, ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-95 | 20-40 | 4-20 |
| | 8-40 | Silty clay loam, silt loam. | CL, ML | A-6, A-7, A-4 | 0 | 100 | 100 | 90-100 | 75-100 | 30-45 | 8-18 |
| | 40-80 | Clay loam, silty clay loam, clay. | CL, CH, ML, MH | A-6, A-7 | 0 | 95-100 | 85-95 | 80-95 | 70-95 | 35-60 | 15-30 |
| | 80-90 | Clay loam, silty clay loam, clay. | CL, CH, ML, MH | A-6, A-7 | 0 | 95-100 | 85-95 | 80-95 | 70-95 | 35-60 | 15-30 |
| BoD2------------- Bonnell | 0-6 | Silt loam-------- | ML, CL-ML, CL | A-4, A-6 | 0 | 95-100 | 95-100 | 85-100 | 65-90 | 25-35 | 4-12 |
| | 6-30 | Silty clay, clay, clay loam. | CH | A-7 | 0 | 95-100 | 95-100 | 90-100 | 75-95 | 50-65 | 30-40 |
| | 30-60 | Clay loam, loam | CL | A-6, A-7 | 0-10 | 95-100 | 90-100 | 85-95 | 60-80 | 30-50 | 15-30 |
| BoE, BoF--------- Bonnell | 0-8 | Silt loam-------- | ML, CL-ML, CL | A-4, A-6 | 0 | 95-100 | 95-100 | 85-100 | 65-90 | 25-35 | 4-12 |
| | 8-30 | Silty clay, clay, clay loam. | CH | A-7 | 0 | 95-100 | 95-100 | 90-100 | 75-95 | 50-65 | 30-40 |
| | 30-60 | Clay loam, loam | CL | A-6, A-7 | 0-10 | 95-100 | 90-100 | 85-95 | 60-80 | 30-50 | 15-30 |
| BrD3------------- Bonnell | 0-5 | Silty clay loam | CL | A-6 | 0 | 95-100 | 95-100 | 85-100 | 65-90 | 30-40 | 11-16 |
| | 5-27 | Silty clay, clay, clay loam. | CH | A-7 | 0 | 95-100 | 95-100 | 90-100 | 75-95 | 50-65 | 30-40 |
| | 27-60 | Clay loam, loam | CL | A-6, A-7 | 0-10 | 95-100 | 90-100 | 85-95 | 60-80 | 30-50 | 15-30 |

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

| Soil name and map symbol | Depth | USDA texture | Classification: Unified | Classification: AASHTO | Frag- ments > 3 inches | Percentage passing sieve number--: 4 | 10 | 40 | 200 | Liquid limit | Plas- ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | | | | Pct | | | | | Pct | |
| ChF---------- Chili | 0-6 | Loam------------ | ML, CL-ML | A-4 | 0 | 85-100 | 75-100 | 65-85 | 55-75 | 25-35 | 4-10 |
| | 6-39 | Loam, sandy loam, gravelly sandy loam. | ML, SM, GM, CL | A-4, A-2, A-6, A-1-b | 0 | 65-100 | 50-80 | 35-70 | 20-65 | <30 | NP-12 |
| | 39-46 | Very gravelly sandy loam, very gravelly loam, gravelly sandy loam. | SM, GM, GM-GC, SM-SC | A-1, A-2 | 0-5 | 45-80 | 35-75 | 25-55 | 15-35 | <30 | NP-8 |
| | 46-65 | Stratified loamy sand to very gravelly sand. | GW, GM, SP, SM | A-1 | 5-10 | 30-70 | 25-65 | 10-45 | 2-20 | --- | NP |
| CnC2---------- Cincinnati | 0-8 | Silt loam-------- | ML, CL | A-4, A-6 | 0 | 100 | 95-100 | 90-100 | 80-100 | 25-40 | 3-16 |
| | 8-27 | Silty clay loam, loam, silt loam. | CL | A-6, A-4 | 0 | 95-100 | 90-100 | 85-100 | 70-100 | 25-40 | 8-15 |
| | 27-36 | Clay loam, loam, silty clay loam. | CL, CL-ML | A-6, A-4 | 0 | 85-100 | 75-95 | 70-90 | 55-80 | 25-40 | 5-20 |
| | 36-72 | Clay loam, loam, silty clay loam. | CL, ML, CL-ML | A-6, A-4 | 0 | 85-100 | 75-95 | 70-90 | 55-80 | 25-40 | 5-20 |
| | 72-80 | Clay loam, loam | CL, CL-ML | A-6, A-4 | 0 | 95-100 | 80-95 | 70-90 | 55-80 | 25-40 | 5-20 |
| Ct-------------- Clermont | 0-7 | Silt loam-------- | CL, CL-ML, ML | A-4, A-6 | 0 | 95-100 | 95-100 | 85-95 | 75-90 | 20-40 | 3-20 |
| | 7-15 | Silt loam-------- | CL, CL-ML, ML | A-4, A-6 | 0 | 95-100 | 95-100 | 85-95 | 75-90 | 20-40 | 3-20 |
| | 15-31 | Silty clay loam, silt loam. | CL | A-6, A-7 | 0 | 95-100 | 95-100 | 90-100 | 85-95 | 30-45 | 12-25 |
| | 31-56 | Silty clay loam, clay loam. | CL | A-6, A-7 | 0 | 95-100 | 85-100 | 75-100 | 65-95 | 30-45 | 12-25 |
| | 56-80 | Clay loam, clay, silty clay. | CL | A-6, A-7 | 0 | 95-100 | 85-100 | 75-95 | 65-90 | 30-50 | 12-28 |
| EaE, EaF--------- Eden | 0-5 | Flaggy silt loam | CL, CH | A-7, A-6 | 25-40 | 75-95 | 70-95 | 70-95 | 65-95 | 35-65 | 12-35 |
| | 5-34 | Flaggy silty clay, clay, flaggy silty clay loam. | CH, CL | A-7 | 10-45 | 75-100 | 55-100 | 50-100 | 50-95 | 45-75 | 20-45 |
| | 34-60 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| EkB, EkC2-------- Elkinsville | 0-9 | Silt loam-------- | CL-ML, ML | A-4 | 0 | 100 | 100 | 90-100 | 70-90 | <25 | NP-7 |
| | 9-37 | Silty clay loam, silt loam. | CL | A-6, A-4 | 0 | 100 | 100 | 85-100 | 65-90 | 20-35 | 7-15 |
| | 37-63 | Loam, sandy loam, clay loam. | CL, CL-ML, SC, SM-SC | A-4, A-6 | 0 | 100 | 90-100 | 75-100 | 45-80 | 20-35 | 5-15 |
| | 63-80 | Silty clay loam, fine sandy loam, loam. | CL, CL-ML, SC, SM-SC | A-4, A-6 | 0 | 100 | 90-100 | 60-100 | 40-80 | 20-35 | 5-15 |
| FdD2------------ Faywood | 0-9 | Silt loam-------- | ML, CL, CL-ML | A-4 | 0-15 | 100 | 95-100 | 90-100 | 85-100 | 25-35 | 4-10 |
| | 9-28 | Silty clay, clay, silty clay loam. | CH, CL | A-7 | 0-15 | 90-100 | 90-100 | 85-100 | 75-100 | 42-70 | 20-45 |
| | 28-30 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Frag- ments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plas- ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| FeC2*: | | | | | | | | | | | |
| Faywood | 0-9 | Silt loam | ML, CL, CL-ML | A-4 | 0-15 | 100 | 95-100 | 90-100 | 85-100 | 25-35 | 4-10 |
| | 9-28 | Silty clay, clay, silty clay loam. | CH, CL | A-7 | 0-15 | 90-100 | 90-100 | 85-100 | 75-100 | 42-70 | 20-45 |
| | 28-30 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Lowell | 0-6 | Silt loam | ML, CL, CL-ML | A-4 | 0 | 100 | 95-100 | 90-100 | 85-100 | 22-32 | 4-10 |
| | 6-21 | Silty clay, clay, silty clay loam. | CL, CH, MH | A-7, A-6 | 0 | 100 | 95-100 | 90-100 | 85-100 | 35-65 | 15-32 |
| | 21-44 | Clay, silty clay | CH, MH, CL | A-7 | 0-20 | 95-100 | 90-100 | 85-100 | 75-100 | 45-75 | 20-40 |
| | 44-56 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ge Genesee | 0-9 | Silt loam | ML, CL | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-90 | 26-40 | 3-15 |
| | 9-36 | Silt loam, loam | ML, CL | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-90 | 26-40 | 3-15 |
| | 36-60 | Stratified loam and fine sandy loam. | ML, CL, CL-ML | A-4, A-6 | 0 | 90-100 | 85-100 | 60-90 | 50-90 | 20-35 | 3-15 |
| JeC2, JeD2 Jessup | 0-6 | Silt loam | ML, CL-ML, CL | A-4, A-6 | 0 | 100 | 100 | 90-100 | 70-90 | 20-40 | 4-15 |
| | 6-15 | Silt loam, silty clay loam. | CL, ML | A-6, A-4 | 0 | 95-100 | 95-100 | 85-100 | 70-95 | 30-40 | 6-16 |
| | 15-42 | Silty clay loam, silty clay, clay. | CL, CH | A-6, A-7 | 0-5 | 85-100 | 75-100 | 70-100 | 65-95 | 35-55 | 15-30 |
| | 42-80 | Silty clay, clay, silty clay loam. | CL, CH | A-6, A-7 | 0-5 | 85-100 | 75-100 | 70-100 | 65-100 | 35-60 | 15-30 |
| Ju Jules | 0-7 | Silt loam | ML | A-4 | 0 | 100 | 100 | 90-100 | 80-90 | 27-36 | 4-10 |
| | 7-60 | Silt loam | ML | A-4 | 0 | 100 | 100 | 90-100 | 80-100 | 27-36 | 4-10 |
| LoB2 Loudon | 0-7 | Silt loam | ML, CL-ML, CL | A-4, A-6 | 0 | 100 | 95-100 | 85-100 | 65-90 | 25-40 | 4-12 |
| | 7-14 | Silt loam, silty clay loam. | CL, ML | A-6, A-4 | 0 | 100 | 95-100 | 90-100 | 75-95 | 30-40 | 6-16 |
| | 14-37 | Silty clay loam, silty clay, clay. | CL, CH | A-6, A-7 | 0-5 | 85-100 | 75-95 | 70-95 | 65-90 | 35-55 | 15-30 |
| | 37-59 | Silty clay, clay, silty clay loam. | CH, CL | A-7 | 0-5 | 85-100 | 75-100 | 70-100 | 65-95 | 45-65 | 20-35 |
| | 59-72 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| LwB2 Lowell | 0-6 | Silt loam | ML, CL, CL-ML | A-4 | 0 | 100 | 95-100 | 90-100 | 85-100 | 22-32 | 4-10 |
| | 6-21 | Silty clay, clay, silty clay loam. | CL, CH, MH | A-7, A-6 | 0 | 100 | 95-100 | 90-100 | 85-100 | 35-65 | 15-32 |
| | 21-44 | Clay, silty clay | CH, MH, CL | A-7 | 0-20 | 95-100 | 90-100 | 85-100 | 75-100 | 45-75 | 20-40 |
| | 44-56 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No Nolin | 0-9 | Silt loam | CL, CL-ML | A-4, A-6 | 0 | 100 | 95-100 | 90-100 | 80-100 | 25-40 | 5-18 |
| | 9-52 | Silt loam, silty clay loam. | CL, CL-ML | A-4, A-6, A-7 | 0 | 100 | 95-100 | 85-100 | 75-100 | 25-46 | 5-23 |
| | 52-72 | Loam, silt loam, gravelly loam. | ML, CL, CL-ML, GM | A-4, A-6 | 0-10 | 50-100 | 50-100 | 40-95 | 35-95 | <30 | NP-15 |

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

| Soil name and map symbol | Depth | USDA texture | Classification: Unified | Classification: AASHTO | Frag- ments > 3 inches | Percentage passing sieve number-- 4 | 10 | 40 | 200 | Liquid limit | Plas- ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | | | | Pct | | | | | Pct | |
| PaC2-------------- Pate | 0-8 | Silty clay------- | CL, CH, MH | A-7 | 0-5 | 90-100 | 85-100 | 80-100 | 75-100 | 45-65 | 20-35 |
| | 8-32 | Silty clay loam, silty clay, clay. | CL, CH | A-7 | 0-5 | 90-100 | 85-100 | 80-100 | 70-100 | 40-65 | 20-40 |
| | 32-75 | Flaggy silty clay, very flaggy clay. | CL, CH | A-6, A-7 | 5-40 | 75-100 | 70-100 | 65-100 | 60-95 | 25-60 | 10-30 |
| | 75-80 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| PaD2, PaE2------- Pate | 0-4 | Silty clay------- | CL, CH, MH | A-7 | 0-5 | 90-100 | 85-100 | 80-100 | 75-100 | 45-65 | 20-35 |
| | 4-32 | Silty clay loam, silty clay, clay. | CL, CH | A-7 | 0-5 | 90-100 | 85-100 | 80-100 | 70-100 | 40-65 | 20-40 |
| | 32-75 | Flaggy silty clay, very flaggy clay. | CL, CH | A-6, A-7 | 5-40 | 75-100 | 70-100 | 65-100 | 60-95 | 25-60 | 10-30 |
| | 75-80 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RpB-------------- Rossmoyne | 0-9 | Silt loam-------- | ML | A-4 | 0 | 100 | 100 | 95-100 | 90-100 | 30-40 | 4-10 |
| | 9-20 | Silty clay loam, silt loam, clay loam. | CL, ML | A-6, A-7, A-4 | 0 | 100 | 95-100 | 85-100 | 80-95 | 30-48 | 8-20 |
| | 20-38 | Clay loam, loam, silty clay loam. | CL | A-6, A-4 | 0 | 90-100 | 85-95 | 80-90 | 70-85 | 25-40 | 9-19 |
| | 38-78 | Clay loam, loam, clay. | CL | A-6, A-7, A-4 | 0 | 80-95 | 70-90 | 65-85 | 60-80 | 25-42 | 8-20 |
| RpC2------------- Rossmoyne | 0-6 | Silt loam-------- | ML | A-4 | 0 | 100 | 100 | 95-100 | 90-100 | 30-40 | 4-10 |
| | 6-18 | Silty clay loam, silt loam, clay loam. | CL, ML | A-6, A-7, A-4 | 0 | 100 | 95-100 | 85-100 | 80-95 | 30-48 | 8-20 |
| | 18-36 | Clay loam, loam, silty clay loam. | CL | A-6, A-4 | 0 | 90-100 | 85-95 | 80-90 | 70-85 | 25-40 | 9-19 |
| | 36-75 | Clay loam, loam, clay. | CL | A-6, A-7, A-4 | 0 | 80-95 | 70-90 | 65-85 | 60-80 | 25-42 | 8-20 |
| RwC3*: | | | | | | | | | | | |
| Rossmoyne------- | 0-5 | Silty clay loam | CL | A-6 | 0 | 100 | 95-100 | 90-100 | 85-100 | 30-40 | 11-17 |
| | 5-16 | Silty clay loam, silt loam, clay loam. | CL, ML | A-6, A-7, A-4 | 0 | 100 | 95-100 | 85-100 | 80-95 | 30-48 | 8-20 |
| | 16-34 | Clay loam, loam, silty clay loam. | CL | A-6, A-4 | 0 | 90-100 | 85-95 | 80-90 | 70-85 | 25-40 | 9-19 |
| | 34-68 | Clay loam, loam, clay. | CL | A-6, A-7, A-4 | 0 | 80-95 | 70-90 | 65-85 | 60-80 | 25-42 | 8-20 |
| Bonnell--------- | 0-5 | Clay loam-------- | CL | A-6 | 0 | 95-100 | 95-100 | 85-100 | 65-90 | 30-40 | 11-16 |
| | 5-32 | Silty clay, clay, clay loam. | CH | A-7 | 0 | 95-100 | 95-100 | 90-100 | 75-95 | 50-65 | 30-40 |
| | 32-60 | Clay loam, loam | CL | A-6, A-7 | 0-10 | 95-100 | 90-100 | 85-95 | 60-80 | 30-50 | 15-30 |
| SaB-------------- Sardinia | 0-9 | Silt loam-------- | ML, CL-ML | A-4 | 0 | 90-100 | 85-100 | 75-95 | 60-85 | 25-35 | 3-10 |
| | 9-35 | Silty clay loam, silt loam. | ML, CL | A-6, A-7 | 0 | 90-100 | 85-100 | 80-100 | 65-100 | 30-50 | 10-20 |
| | 35-64 | Clay loam, silty clay loam, loam. | CL, SC, ML, GC | A-6, A-2, A-4 | 0 | 65-100 | 50-100 | 45-95 | 25-85 | 25-40 | 5-20 |
| | 64-80 | Stratified gravelly sandy clay loam to silty clay loam. | SC, ML, GM-GC, CL | A-6, A-4, A-2 | 0 | 65-95 | 50-90 | 45-80 | 25-55 | 25-40 | 5-15 |

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Frag- ments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plas- ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| ScA-------------- Sciotoville | 0-9 | Silt loam-------- | CL-ML, ML | A-4 | 0 | 95-100 | 95-100 | 90-100 | 65-95 | 25-35 | 4-10 |
| | 9-31 | Silt loam, silty clay loam, loam. | CL, CL-ML | A-4, A-6 | 0 | 95-100 | 90-100 | 85-100 | 70-90 | 20-35 | 4-15 |
| | 31-42 | Silt loam, silty clay loam, loam. | CL, CL-ML | A-4, A-6 | 0-5 | 95-100 | 90-100 | 85-100 | 65-90 | 25-40 | 4-18 |
| | 42-60 | Stratified silty clay loam to sandy loam. | ML, CL, SM, SC | A-4, A-6 | 0-15 | 75-100 | 75-100 | 65-100 | 45-70 | 5-35 | NP-15 |
| Sh--------------- Shoals | 0-8 | Silt loam-------- | CL, CL-ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 65-90 | 20-35 | 6-15 |
| | 8-30 | Silt loam, loam, clay loam. | CL, CL-ML | A-4, A-6 | 0 | 100 | 100 | 90-100 | 75-85 | 25-40 | 5-15 |
| | 30-60 | Stratified silt loam to sandy loam. | ML, CL, CL-ML | A-4 | 0-3 | 90-100 | 85-100 | 60-80 | 50-70 | <30 | 4-10 |
| WvB-------------- Williamsburg | 0-9 | Silt loam-------- | ML, CL, CL-ML | A-4, A-6 | 0 | 95-100 | 95-100 | 90-100 | 70-90 | 25-35 | 3-13 |
| | 9-33 | Silt loam, silty clay loam. | CL, ML, CL-ML | A-4, A-6 | 0 | 95-100 | 95-100 | 90-100 | 70-100 | 25-40 | 3-18 |
| | 33-43 | Clay loam, sandy clay loam. | CL, SC | A-6, A-7 | 0 | 90-100 | 85-100 | 75-95 | 45-75 | 30-45 | 15-25 |
| | 43-80 | Gravelly clay loam, sandy clay loam, fine gravelly sandy clay. | CL, SC | A-6, A-7, A-2 | 0 | 80-100 | 50-95 | 45-90 | 25-70 | 30-50 | 15-30 |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

| Soil name and map symbol | Depth | Clay | Moist bulk density | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors K | Erosion factors T | Wind erodibility group | Organic matter |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | Pct | g/cc | In/hr | In/in | pH | | | | | Pct |
| Ag---------------- Algiers | 0-5 | 15-27 | 1.20-1.45 | 0.6-2.0 | 0.16-0.20 | 6.1-7.3 | Low----------- | 0.37 | 5 | 6 | 2-4 |
| | 5-49 | 20-35 | 1.25-1.65 | 0.6-2.0 | 0.16-0.20 | 6.1-7.8 | Low----------- | 0.37 | | | |
| | 49-60 | 0-5 | 1.60-1.70 | 2.0-6.0 | 0.02-0.04 | 6.1-8.4 | Low----------- | 0.10 | | | |
| AtC2-------------- Atlas | 0-6 | 30-40 | 1.40-1.60 | 0.06-0.2 | 0.21-0.23 | 4.5-7.3 | High---------- | 0.43 | 3 | 7 | .5-1 |
| | 6-58 | 35-45 | 1.50-1.70 | <0.06 | 0.09-0.13 | 4.5-7.3 | High---------- | 0.32 | | | |
| | 58-80 | 20-30 | 1.55-1.80 | 0.06-0.2 | 0.12-0.15 | 6.1-7.8 | Moderate------ | 0.32 | | | |
| AvA--------------- Avonburg | 0-8 | 10-18 | 1.30-1.45 | 0.6-2.0 | 0.20-0.24 | 4.5-7.3 | Low----------- | 0.43 | 4 | 5 | .5-2 |
| | 8-29 | 22-30 | 1.35-1.50 | 0.6-2.0 | 0.18-0.20 | 4.5-5.5 | Moderate------ | 0.43 | | | |
| | 29-45 | 22-30 | 1.60-1.85 | <0.06 | 0.06-0.08 | 4.5-5.5 | Moderate------ | 0.43 | | | |
| | 45-80 | 14-30 | 1.50-1.70 | <0.06 | 0.06-0.10 | 4.5-8.4 | Moderate------ | 0.43 | | | |
| AwB2*: | | | | | | | | | | | |
| Avonburg--------- | 0-6 | 10-18 | 1.30-1.45 | 0.6-2.0 | 0.20-0.24 | 4.5-7.3 | Low----------- | 0.43 | 4 | 5 | .5-2 |
| | 6-31 | 22-30 | 1.35-1.50 | 0.6-2.0 | 0.18-0.20 | 4.5-5.5 | Moderate------ | 0.43 | | | |
| | 31-80 | 14-30 | 1.50-1.70 | <0.06 | 0.06-0.10 | 4.5-8.4 | Moderate------ | 0.43 | | | |
| Atlas------------ | 0-6 | 30-40 | 1.40-1.60 | 0.06-0.2 | 4.5-7.3 | 4.5-7.3 | High---------- | 0.43 | 3 | 7 | .5-1 |
| | 6-58 | 35-45 | 1.50-1.70 | <0.06 | 0.09-0.13 | 4.5-7.3 | High---------- | 0.32 | | | |
| | 58-80 | 20-30 | 1.55-1.80 | 0.06-0.2 | 0.12-0.15 | 6.1-7.8 | Moderate------ | 0.32 | | | |
| Bc---------------- Blanchester | 0-8 | 15-30 | 1.30-1.55 | 0.6-2.0 | 0.19-0.24 | 4.5-6.5 | Low----------- | 0.37 | 4 | 6 | 1-3 |
| | 8-40 | 25-35 | 1.45-1.65 | 0.06-0.2 | 0.14-0.22 | 4.5-6.0 | Moderate------ | 0.37 | | | |
| | 40-80 | 30-45 | 1.45-1.70 | <0.2 | 0.13-0.20 | 4.5-7.3 | High---------- | 0.37 | | | |
| | 80-90 | 32-48 | 1.50-1.80 | <0.2 | 0.07-0.18 | 6.6-8.4 | High---------- | 0.37 | | | |
| BoD2-------------- Bonnell | 0-6 | 15-25 | 1.30-1.45 | 0.6-2.0 | 0.22-0.24 | 4.5-7.3 | Low----------- | 0.43 | 3 | 5 | 1-3 |
| | 6-30 | 40-60 | 1.50-1.70 | 0.06-0.2 | 0.09-0.13 | 4.5-6.0 | High---------- | 0.32 | | | |
| | 30-60 | 25-40 | 1.45-1.60 | 0.2-0.6 | 0.08-0.15 | 6.1-8.4 | Moderate------ | 0.32 | | | |
| BoE, BoF---------- Bonnell | 0-8 | 15-25 | 1.30-1.45 | 0.6-2.0 | 0.22-0.24 | 4.5-7.3 | Low----------- | 0.43 | 3 | 5 | 1-3 |
| | 8-30 | 40-60 | 1.50-1.70 | 0.06-0.2 | 0.09-0.13 | 4.5-6.0 | High---------- | 0.32 | | | |
| | 30-60 | 25-40 | 1.45-1.60 | 0.2-0.6 | 0.08-0.15 | 6.1-8.4 | Moderate------ | 0.32 | | | |
| BrD3-------------- Bonnell | 0-5 | 27-32 | 1.30-1.50 | 0.2-0.6 | 0.21-0.23 | 4.5-7.3 | Moderate------ | 0.43 | 3 | 7 | .5-1 |
| | 5-27 | 40-60 | 1.50-1.70 | 0.06-0.2 | 0.09-0.13 | 4.5-6.0 | High---------- | 0.32 | | | |
| | 27-60 | 25-40 | 1.45-1.60 | 0.2-0.6 | 0.08-0.15 | 6.1-8.4 | Moderate------ | 0.32 | | | |
| ChF--------------- Chili | 0-6 | 5-18 | 1.30-1.50 | 0.6-2.0 | 0.14-0.18 | 4.5-7.3 | Low----------- | 0.32 | 4 | 5 | 1-3 |
| | 6-39 | 18-27 | 1.30-1.55 | 2.0-6.0 | 0.09-0.16 | 4.5-6.5 | Low----------- | 0.32 | | | |
| | 39-46 | 5-18 | 1.30-1.55 | 2.0-6.0 | 0.06-0.12 | 5.1-6.5 | Low----------- | 0.17 | | | |
| | 46-65 | 1-10 | 1.25-1.50 | 6.0-20 | 0.02-0.08 | 5.1-7.8 | Low----------- | 0.10 | | | |
| CnC2-------------- Cincinnati | 0-8 | 18-27 | 1.30-1.50 | 0.6-2.0 | 0.22-0.24 | 4.5-7.3 | Low----------- | 0.43 | 4 | 6 | 1-3 |
| | 8-27 | 22-35 | 1.45-1.65 | 0.6-2.0 | 0.15-0.19 | 4.5-5.5 | Low----------- | 0.37 | | | |
| | 27-36 | 25-35 | 1.60-1.85 | 0.06-0.6 | 0.08-0.12 | 4.5-6.5 | Moderate------ | 0.37 | | | |
| | 36-72 | 25-40 | 1.55-1.75 | 0.06-0.6 | 0.08-0.12 | 4.5-6.5 | Moderate------ | 0.37 | | | |
| | 72-80 | 25-40 | 1.55-1.75 | 0.06-0.6 | 0.08-0.12 | 6.1-8.4 | Moderate------ | 0.37 | | | |
| Ct---------------- Clermont | 0-7 | 15-25 | 1.30-1.50 | 0.2-0.6 | 0.22-0.24 | 4.5-5.5 | Low----------- | 0.43 | 5 | 6 | 1-3 |
| | 7-15 | 15-25 | 1.35-1.55 | 0.06-0.2 | 0.20-0.22 | 3.6-5.5 | Low----------- | 0.43 | | | |
| | 15-31 | 24-35 | 1.45-1.65 | <0.06 | 0.18-0.22 | 3.6-5.5 | Moderate------ | 0.43 | | | |
| | 31-56 | 32-40 | 1.50-1.70 | <0.06 | 0.15-0.20 | 4.5-7.3 | Moderate------ | 0.37 | | | |
| | 56-80 | 35-45 | 1.50-1.70 | <0.06 | 0.10-0.18 | 4.5-7.3 | Moderate------ | 0.37 | | | |

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

| Soil name and map symbol | Depth | Clay | Moist bulk density | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors K | Erosion factors T | Wind erodibility group | Organic matter |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | Pct | g/cc | In/hr | In/in | pH | | | | | Pct |
| EaE, EaF---------<br>Eden | 0-5 | 12-27 | 1.30-1.50 | 0.06-0.6 | 0.12-0.18 | 4.5-8.4 | Moderate----- | 0.17 | 3 | --- | .5-1 |
| | 5-34 | 40-60 | 1.45-1.65 | 0.06-0.2 | 0.08-0.13 | 5.1-8.4 | Moderate----- | 0.28 | | | |
| | 34-60 | --- | --- | --- | --- | --- | ------------- | ---- | | | |
| EkB, EkC2--------<br>Elkinsville | 0-9 | 7-18 | 1.30-1.45 | 0.6-2.0 | 0.22-0.24 | 5.6-7.3 | Low---------- | 0.37 | 5 | 5 | 2-4 |
| | 9-37 | 19-30 | 1.40-1.60 | 0.6-2.0 | 0.18-0.22 | 4.5-5.5 | Moderate----- | 0.37 | | | |
| | 37-63 | 16-30 | 1.45-1.65 | 0.6-2.0 | 0.15-0.19 | 4.5-5.5 | Moderate----- | 0.37 | | | |
| | 63-80 | 14-30 | 1.40-1.60 | 0.6-2.0 | 0.11-0.20 | 4.5-6.0 | Low---------- | 0.37 | | | |
| FdD2-------------<br>Faywood | 0-9 | 15-27 | 1.30-1.40 | 0.6-2.0 | 0.18-0.22 | 5.1-7.8 | Low---------- | 0.37 | 3 | 6 | 1-2 |
| | 9-28 | 35-60 | 1.35-1.45 | 0.06-0.6 | 0.12-0.17 | 5.1-7.8 | Moderate----- | 0.28 | | | |
| | 28-30 | --- | --- | --- | --- | --- | ------------- | ---- | | | |
| FeC2*: | | | | | | | | | | | |
| Faywood--------- | 0-9 | 15-27 | 1.30-1.40 | 0.6-2.0 | 0.18-0.22 | 5.1-7.8 | Low---------- | 0.37 | 3 | 6 | 1-2 |
| | 9-28 | 35-60 | 1.35-1.45 | 0.06-0.6 | 0.12-0.17 | 5.1-7.8 | Moderate----- | 0.28 | | | |
| | 28-30 | --- | --- | --- | --- | --- | ------------- | ---- | | | |
| Lowell---------- | 0-6 | 12-27 | 1.20-1.40 | 0.6-2.0 | 0.18-0.23 | 4.5-6.5 | Low---------- | 0.37 | 3 | 6 | 1-2 |
| | 6-21 | 35-60 | 1.30-1.60 | 0.2-2.0 | 0.13-0.19 | 4.5-6.5 | Moderate----- | 0.28 | | | |
| | 21-44 | 40-60 | 1.50-1.70 | 0.2-0.6 | 0.12-0.17 | 5.1-7.8 | Moderate----- | 0.28 | | | |
| | 44-56 | --- | --- | --- | --- | --- | ------------- | ---- | | | |
| Ge---------------<br>Genesee | 0-9 | 18-27 | 1.30-1.50 | 0.6-2.0 | 0.20-0.24 | 6.1-7.8 | Low---------- | 0.37 | 5 | 6 | 1-3 |
| | 9-36 | 18-27 | 1.30-1.50 | 0.6-2.0 | 0.17-0.22 | 6.1-8.4 | Low---------- | 0.37 | | | |
| | 36-60 | 10-20 | 1.30-1.50 | 0.6-2.0 | 0.19-0.21 | 7.4-8.4 | Low---------- | 0.37 | | | |
| JeC2, JeD2-------<br>Jessup | 0-6 | 18-27 | 1.30-1.50 | 0.6-2.0 | 0.22-0.24 | 4.5-6.0 | Low---------- | 0.43 | 3 | 6 | 1-3 |
| | 6-15 | 25-40 | 1.30-1.65 | 0.2-0.6 | 0.18-0.22 | 4.5-6.0 | Moderate----- | 0.43 | | | |
| | 15-42 | 35-55 | 1.40-1.65 | 0.06-0.2 | 0.10-0.18 | 4.5-7.3 | Moderate----- | 0.32 | | | |
| | 42-80 | 35-60 | 1.40-1.75 | 0.06-0.2 | 0.08-0.16 | 6.6-8.4 | Moderate----- | 0.32 | | | |
| Ju---------------<br>Jules | 0-7 | 10-20 | 1.15-1.40 | 0.6-2.0 | 0.20-0.24 | 7.4-8.4 | Low---------- | 0.37 | 5 | 4L | 1-2 |
| | 7-60 | 10-18 | 1.20-1.50 | 0.6-2.0 | 0.17-0.22 | 7.4-8.4 | Low---------- | 0.37 | | | |
| LoB2-------------<br>Loudon | 0-7 | 15-27 | 1.30-1.50 | 0.6-2.0 | 0.22-0.24 | 5.1-6.0 | Low---------- | 0.43 | 3 | 6 | 1-3 |
| | 7-14 | 25-40 | 1.30-1.60 | 0.2-0.6 | 0.18-0.22 | 4.5-6.0 | Moderate----- | 0.43 | | | |
| | 14-37 | 35-60 | 1.40-1.65 | 0.06-0.2 | 0.10-0.18 | 4.5-6.0 | Moderate----- | 0.32 | | | |
| | 37-59 | 35-65 | 1.40-1.75 | 0.06-0.2 | 0.08-0.16 | 6.6-8.4 | Moderate----- | 0.32 | | | |
| | 59-72 | --- | --- | --- | --- | --- | ------------- | ---- | | | |
| LwB2-------------<br>Lowell | 0-6 | 12-27 | 1.20-1.40 | 0.6-2.0 | 0.18-0.23 | 4.5-6.5 | Low---------- | 0.37 | 3 | 6 | 1-2 |
| | 6-21 | 35-60 | 1.30-1.60 | 0.2-2.0 | 0.13-0.19 | 4.5-6.5 | Moderate----- | 0.28 | | | |
| | 21-44 | 40-60 | 1.50-1.70 | 0.2-0.6 | 0.12-0.17 | 5.1-7.8 | Moderate----- | 0.28 | | | |
| | 44-56 | --- | --- | --- | --- | --- | ------------- | ---- | | | |
| No---------------<br>Nolin | 0-9 | 12-35 | 1.20-1.40 | 0.6-2.0 | 0.18-0.23 | 5.6-8.4 | Low---------- | 0.43 | 5 | 5 | 2-4 |
| | 9-52 | 18-35 | 1.25-1.50 | 0.6-2.0 | 0.18-0.23 | 5.6-8.4 | Low---------- | 0.43 | | | |
| | 52-72 | 10-30 | 1.30-1.55 | 0.6-6.0 | 0.10-0.23 | 5.1-8.4 | Low---------- | 0.43 | | | |
| PaC2-------------<br>Pate | 0-8 | 40-50 | 1.45-1.60 | 0.06-0.2 | 0.12-0.14 | 5.6-7.3 | Moderate----- | 0.32 | 3 | 4 | 1-3 |
| | 8-32 | 35-55 | 1.50-1.70 | <0.06 | 0.08-0.16 | 5.6-7.3 | High--------- | 0.37 | | | |
| | 32-75 | 35-60 | 1.60-1.80 | <0.06 | 0.05-0.12 | 6.1-8.4 | High--------- | 0.37 | | | |
| | 75-80 | --- | --- | --- | --- | --- | ------------- | ---- | | | |
| PaD2, PaE2-------<br>Pate | 0-4 | 40-50 | 1.45-1.60 | 0.06-0.2 | 0.12-0.14 | 5.6-7.3 | Moderate----- | 0.32 | 3 | 4 | 1-3 |
| | 4-32 | 35-55 | 1.50-1.70 | <0.06 | 0.08-0.16 | 5.6-7.3 | High--------- | 0.37 | | | |
| | 32-75 | 35-60 | 1.60-1.80 | <0.06 | 0.05-0.12 | 6.1-8.4 | High--------- | 0.37 | | | |
| | 75-80 | --- | --- | --- | --- | --- | ------------- | ---- | | | |

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

| Soil name and map symbol | Depth | Clay | Moist bulk density | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors K | Erosion factors T | Wind erodi- bility group | Organic matter |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | Pct | g/cc | In/hr | In/in | pH | | | | | Pct |
| RpB-------------- Rossmoyne | 0-9 | 13-27 | 1.35-1.50 | 0.6-2.0 | 0.20-0.24 | 4.5-7.3 | Low---------- | 0.37 | 4 | 6 | 1-3 |
| | 9-20 | 22-35 | 1.40-1.60 | 0.6-2.0 | 0.14-0.19 | 4.5-5.5 | Moderate----- | 0.43 | | | |
| | 20-38 | 24-35 | 1.70-1.90 | 0.06-0.6 | 0.06-0.10 | 4.5-5.5 | Moderate----- | 0.43 | | | |
| | 38-78 | 18-45 | 1.60-1.75 | 0.06-0.6 | 0.06-0.10 | 5.6-8.4 | Moderate----- | 0.43 | | | |
| RpC2------------- Rossmoyne | 0-6 | 13-27 | 1.35-1.50 | 0.6-2.0 | 0.20-0.24 | 4.5-7.3 | Low---------- | 0.37 | 4 | 6 | 1-3 |
| | 6-18 | 22-35 | 1.40-1.60 | 0.6-2.0 | 0.14-0.19 | 4.5-5.5 | Moderate----- | 0.43 | | | |
| | 18-36 | 24-35 | 1.70-1.90 | 0.06-0.6 | 0.06-0.10 | 4.5-5.5 | Moderate----- | 0.43 | | | |
| | 36-75 | 18-45 | 1.60-1.75 | 0.06-0.6 | 0.06-0.10 | 5.6-8.4 | Moderate----- | 0.43 | | | |
| RwC3*: | | | | | | | | | | | |
| Rossmoyne------- | 0-5 | 27-32 | 1.35-1.55 | 0.6-2.0 | 0.19-0.23 | 4.5-7.3 | Low---------- | 0.43 | 3 | 7 | .5-2 |
| | 5-16 | 22-35 | 1.40-1.60 | 0.6-2.0 | 0.14-0.19 | 4.5-5.5 | Moderate----- | 0.43 | | | |
| | 16-34 | 24-35 | 1.70-1.90 | 0.06-0.6 | 0.06-0.10 | 4.5-5.5 | Moderate----- | 0.43 | | | |
| | 34-68 | 18-45 | 1.60-1.75 | 0.06-0.6 | 0.06-0.10 | 5.6-8.4 | Moderate----- | 0.43 | | | |
| Bonnell--------- | 0-5 | 27-32 | 1.30-1.50 | 0.2-0.6 | 0.17-0.19 | 4.5-7.3 | Moderate----- | 0.43 | 3 | 7 | .5-3 |
| | 5-32 | 40-60 | 1.50-1.70 | 0.06-0.2 | 0.09-0.13 | 4.5-6.0 | High--------- | 0.32 | | | |
| | 32-60 | 25-40 | 1.45-1.60 | 0.2-0.6 | 0.08-0.15 | 6.1-8.4 | Moderate----- | 0.32 | | | |
| SaB-------------- Sardinia | 0-9 | 20-27 | 1.30-1.50 | 0.6-2.0 | 0.20-0.24 | 5.6-7.3 | Low---------- | 0.37 | 5 | 6 | 1-3 |
| | 9-35 | 24-35 | 1.35-1.60 | 0.2-2.0 | 0.18-0.22 | 5.1-6.5 | Moderate----- | 0.37 | | | |
| | 35-64 | 20-35 | 1.35-1.60 | 0.6-2.0 | 0.15-0.18 | 5.6-7.3 | Moderate----- | 0.37 | | | |
| | 64-80 | 20-35 | 1.25-1.55 | 0.6-6.0 | 0.12-0.16 | 5.6-8.4 | Low---------- | 0.37 | | | |
| ScA-------------- Sciotoville | 0-9 | 15-27 | 1.30-1.45 | 0.6-2.0 | 0.18-0.22 | 5.1-6.5 | Low---------- | 0.37 | 4 | 6 | 1-3 |
| | 9-31 | 20-32 | 1.40-1.60 | 0.6-2.0 | 0.17-0.21 | 4.5-5.5 | Low---------- | 0.37 | | | |
| | 31-42 | 20-32 | 1.60-1.80 | 0.06-0.6 | 0.10-0.14 | 4.5-6.0 | Low---------- | 0.37 | | | |
| | 42-60 | 15-35 | 1.50-1.65 | 2.0-6.0 | 0.10-0.14 | 5.1-6.5 | Low---------- | 0.37 | | | |
| Sh--------------- Shoals | 0-8 | 18-27 | 1.30-1.50 | 0.6-2.0 | 0.22-0.24 | 6.1-7.8 | Low---------- | 0.32 | 5 | 6 | 2-5 |
| | 8-30 | 18-33 | 1.35-1.55 | 0.6-2.0 | 0.17-0.22 | 6.1-7.8 | Low---------- | 0.37 | | | |
| | 30-60 | 12-25 | 1.35-1.60 | 0.6-2.0 | 0.12-0.21 | 6.1-8.4 | Low---------- | 0.37 | | | |
| WvB-------------- Williamsburg | 0-9 | 15-25 | 1.30-1.50 | 0.6-2.0 | 0.20-0.24 | 4.5-6.5 | Low---------- | 0.37 | 5 | 6 | 1-3 |
| | 9-33 | 20-30 | 1.30-1.55 | 0.6-2.0 | 0.17-0.22 | 4.5-6.0 | Low---------- | 0.37 | | | |
| | 33-43 | 25-35 | 1.35-1.60 | 0.6-2.0 | 0.13-0.18 | 4.5-6.0 | Moderate----- | 0.37 | | | |
| | 43-80 | 20-40 | 1.25-1.55 | 2.0-6.0 | 0.12-0.14 | 4.5-6.0 | Moderate----- | 0.24 | | | |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "frequent," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

| Soil name and map symbol | Hydro-logic group | Flooding | | | High water table | | | Bedrock | | Potential frost action | Risk of corrosion | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness | | Uncoated steel | Concrete |
| | | | | | Ft | | | In | | | | |
| Ag----------------- Algiers | C/D | Frequent---- | Very brief | Dec-Jun | 1.0-2.0 | Apparent | Jan-Jun | >60 | --- | High----- | High----- | Low. |
| AtC2--------------- Atlas | D | None-------- | --- | --- | 1.0-2.0 | Perched | Apr-Jun | >60 | --- | High----- | High----- | Moderate. |
| AvA---------------- Avonburg | D | None-------- | --- | --- | 1.0-3.0 | Perched | Jan-Apr | >60 | --- | High----- | High----- | High. |
| AwB2*: | | | | | | | | | | | | |
| Avonburg---------- | D | None-------- | --- | --- | 1.0-3.0 | Perched | Jan-Apr | >60 | --- | High----- | High----- | High. |
| Atlas------------- | D | None-------- | --- | --- | 1.0-2.0 | Perched | Apr-Jun | >60 | --- | High----- | High----- | Moderate. |
| Bc----------------- Blanchester | B/D | None-------- | --- | --- | +1-0.5 | Apparent | Jan-Apr | >60 | --- | High----- | High----- | High. |
| BoD2, BoE, BoF, BrD3-------------- Bonnell | C | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | High----- | Moderate. |
| ChF---------------- Chili | B | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | Low------ | High. |
| CnC2--------------- Cincinnati | C | None-------- | --- | --- | 2.5-4.0 | Perched | Jan-Apr | >60 | --- | High----- | Moderate | High. |
| Ct----------------- Clermont | D | None-------- | --- | --- | +1-1.0 | Apparent | Nov-May | >60 | --- | High----- | High----- | High. |
| EaE, EaF----------- Eden | C | None-------- | --- | --- | >6.0 | --- | --- | 20-40 | Soft | Moderate | Moderate | Low. |
| EkB, EkC2---------- Elkinsville | B | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | High----- | Moderate | High. |
| FdD2--------------- Faywood | C | None-------- | --- | --- | >6.0 | --- | --- | 20-40 | Hard | Moderate | High----- | Moderate. |

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

| Soil name and map symbol | Hydro-logic group | Flooding | | | High water table | | | Bedrock | | Potential frost action | Risk of corrosion | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness | | Uncoated steel | Concrete |
| | | | | | Ft | | | In | | | | |
| FeC2*: | | | | | | | | | | | | |
| Faywood---------- | C | None-------- | --- | --- | >6.0 | --- | --- | 20-40 | Hard | Moderate | High----- | Moderate. |
| Lowell----------- | C | None-------- | --- | --- | >6.0 | --- | --- | >40 | Hard | Moderate | High----- | Moderate. |
| Ge---------------- Genesee | B | Occasional | Brief----- | Oct-Jun | >6.0 | --- | --- | >60 | --- | Moderate | Low------ | Low. |
| JeC2, JeD2-------- Jessup | C | None-------- | --- | --- | >6.0 | --- | --- | 40-84 | Soft | Moderate | High----- | Moderate. |
| Ju---------------- Jules | B | Frequent-- - | Brief----- | Mar-Jun | >6.0 | --- | --- | >60 | --- | High----- | Low------ | Low. |
| LoB2-------------- Loudon | C | None-------- | --- | --- | 2.0-3.5 | Perched | Jan-Apr | 40-84 | Soft | High----- | High----- | Moderate. |
| LwB2-------------- Lowell | C | None-------- | --- | --- | >6.0 | --- | --- | >40 | Hard | Moderate | High----- | Moderate. |
| No---------------- Nolin | B | Occasional | Brief to long. | Feb-May | 3.0-6.0 | Apparent | Feb-Mar | >60 | --- | High----- | Low------ | Moderate. |
| PaC2, PaD2, PaE2-- Pate | C | None-------- | --- | --- | >6.0 | --- | --- | >50 | Soft | Moderate | High----- | Moderate. |
| RpB, RpC2--------- Rossmoyne | C | None-------- | --- | --- | 1.5-3.0 | Perched | Jan-Apr | >60 | --- | High----- | High----- | High. |
| RwC3*: | | | | | | | | | | | | |
| Rossmoyne--------- | C | None-------- | --- | --- | 1.5-3.0 | Perched | Jan-Apr | >60 | --- | High----- | High----- | High. |
| Bonnell----------- | C | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | High----- | Moderate. |
| SaB--------------- Sardinia | C | None-------- | --- | --- | 1.5-3.0 | Perched | Jan-Apr | >60 | --- | High----- | High----- | Moderate. |
| ScA--------------- Sciotoville | C | None-------- | --- | --- | 1.5-3.0 | Perched | Nov-Mar | >60 | --- | High----- | Moderate | High. |
| Sh---------------- Shoals | C | Frequent---- | Brief----- | Oct-Jun | 0.5-1.5 | Apparent | Jan-Apr | >60 | --- | High----- | High----- | Low. |
| WvB--------------- Williamsburg | B | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | Moderate | Moderate. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

| Soil name | Family or higher taxonomic class |
|---|---|
| Algiers | Fine-loamy, mixed, nonacid, mesic Aquic Udifluvents |
| Atlas | Fine, montmorillonitic, mesic, sloping Aeric Ochraqualfs |
| *Avonburg | Fine-silty, mixed, mesic Aeric Fragiaqualfs |
| Blanchester | Fine-silty, mixed, mesic Typic Ochraqualfs |
| Bonnell | Fine, mixed, mesic Typic Hapludalfs |
| Chili | Fine-loamy, mixed, mesic Typic Hapludalfs |
| Cincinnati | Fine-silty, mixed, mesic Typic Fragiudalfs |
| Clermont | Fine-silty, mixed, mesic Typic Glossaqualfs |
| Eden | Fine, mixed, mesic Typic Hapludalfs |
| Elkinsville | Fine-silty, mixed, mesic Ultic Hapludalfs |
| Faywood | Fine, mixed, mesic Typic Hapludalfs |
| *Genesee | Fine-loamy, mixed, nonacid, mesic Typic Udifluvents |
| Jessup | Fine, mixed, mesic Typic Hapludalfs |
| Jules | Coarse-silty, mixed (calcareous), mesic Typic Udifluvents |
| Loudon | Fine, mixed, mesic Aquic Hapludalfs |
| Lowell | Fine, mixed, mesic Typic Hapludalfs |
| Nolin | Fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts |
| Pate | Fine, illitic, mesic Typic Hapludalfs |
| Rossmoyne | Fine-silty, mixed, mesic Aquic Fragiudalfs |
| Sardinia | Fine-silty, mixed, mesic Aquic Hapludalfs |
| Sciotoville | Fine-silty, mixed, mesic Aquic Fragiudalfs |
| Shoals | Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents |
| Williamsburg | Fine-loamy, mixed, mesic Ultic Hapludalfs |

TABLE 20.--RELATIONSHIP BETWEEN PARENT MATERIAL, LANDSCAPE POSITION, DEPTH, AND DRAINAGE CLASS

| Landscape position, depth, and parent material | Drainage class | | | |
|---|---|---|---|---|
| | Well drained | Moderately well drained | Somewhat poorly drained | Poorly drained |
| Soils on uplands: | | | | |
| Deep soils formed in loess over glacial till | Cincinnati | Rossmoyne | Avonburg | Clermont, Blanchester. |
| Deep soils formed in glacial till | Bonnell | --- | Atlas | --- |
| Deep soils formed in loess over glacial till and calcareous shale and limestone residuum | Jessup | Loudon | --- | --- |
| Deep soils formed in loess over calcareous shale and limestone residuum | Lowell | --- | --- | --- |
| Deep soils formed in colluvium derived from calcareous shale and limestone | Pate | Pate | --- | --- |
| Moderately deep soils formed in calcareous shale and limestone residuum over soft bedrock | Eden | --- | --- | --- |
| Moderately deep soils formed in calcareous shale and limestone residuum over hard bedrock | Faywood | --- | --- | --- |
| Soils on outwash terraces: | | | | |
| Deep soils formed in loess over glacial outwash or old alluvium | Williamsburg | --- | --- | --- |
| Deep soils formed in old alluvium | --- | Sciotoville | --- | --- |
| Deep soils formed in glacial outwash or old alluvium | Elkinsville | Sardinia | --- | --- |
| Deep soils formed in glacial outwash | Chili | --- | --- | --- |
| Soils on flood plains: | | | | |
| Deep soils formed in silty and loamy recent alluvium | Genesee, Nolin | --- | Shoals | --- |
| Deep soils formed in loamy recent alluvium over a buried soil | --- | --- | Algiers | --- |
| Deep soils formed in silty recent alluvium | Jules | --- | --- | --- |

# Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil was not assigned to the interpretive group)

| Map symbol and soil name | Land capability* | Prime farmland* | Pasture and hayland suitability group | Woodland ordination symbol |
|---|---|---|---|---|
| Ag: Algiers | IIw | Yes** | C-3 | 4A |
| AtC2: Atlas | IIIe | --- | C-2 | 4C |
| AvA: Avonburg | IIw | Yes*** | C-2 | 4D |
| AwB2: | IIe | --- | | |
| Avonburg | | | C-2 | 4D |
| Atlas | | | C-2 | 4C |
| Bc: Blanchester | IIIw | Yes*** | C-1 | 5W |
| BoD2: Bonnell | VIe | --- | A-2 | 4R |
| BoE: Bonnell | VIe | --- | A-3 | 4R |
| BoF: Bonnell | VIIe | --- | H-1 | 4R |
| BrD3: Bonnell | VIe | --- | A-2 | 3R |
| ChF: Chili | VIIe | --- | H-1 | 4R |
| CnC2: Cincinnati | IIIe | --- | F-3 | 4A |
| Ct: Clermont | IIIw | --- | F-7 | 5W |
| EaE: Eden | VIIe | --- | F-2 | 4R |
| EaF: Eden | VIIe | --- | H-1 | 4R |
| EkB: Elkinsville | IIe | Yes | A-6 | 5A |
| EkC2: Elkinsville | IIIe | --- | A-6 | 5A |
| FdD2: Faywood | VIe | --- | F-1 | 4R |
| FeC2: | IIIe | --- | | |
| Faywood | | | F-1 | 4D |
| Lowell | | | A-1 | 5A |
| Ge: Genesee | IIw | Yes | A-5 | 5A |

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

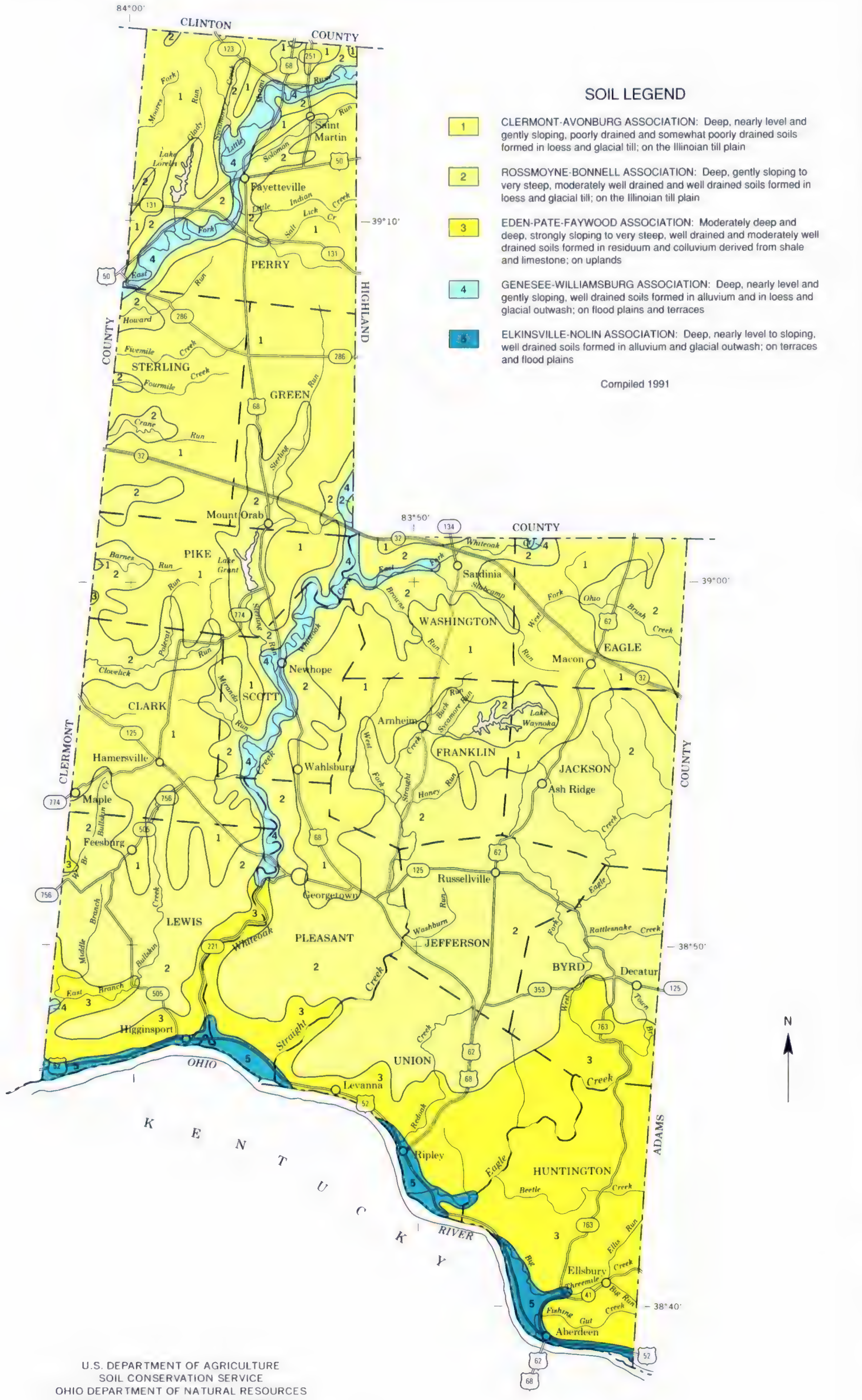
| Map symbol and soil name | Land capability* | Prime farmland* | Pasture and hayland suitability group | Woodland ordination symbol |
|---|---|---|---|---|
| JeC2 Jessup | IIIe | --- | A-1 | 3C |
| JeD2 Jessup | IVe | --- | A-2 | 3R |
| Ju Jules | IIw | Yes** | A-5 | 4A |
| LoB2 Loudon | IIe | --- | A-6 | 4C |
| LwB2 Lowell | IIe | --- | A-1 | 5A |
| No Nolin | IIw | Yes | A-5 | 5A |
| PaC2 Pate | IIIe | --- | A-1 | 5C |
| PaD2 Pate | VIe | --- | A-2 | 5R |
| PaE2 Pate | VIIe | --- | A-3 | 5R |
| RpB Rossmoyne | IIe | Yes | F-3 | 3D |
| RpC2 Rossmoyne | IIIe | --- | F-3 | 3D |
| RwC3 | IVe | --- | | |
| Rossmoyne | | | F-3 | 3D |
| Bonnell | | | A-1 | 3C |
| SaB Sardinia | IIe | Yes | A-6 | 5A |
| ScA Sciotoville | IIw | Yes | F-3 | 4A |
| Sh Shoals | IIw | Yes** | C-3 | 5A |
| WvB Williamsburg | IIe | Yes | A-1 | 5A |

* A complex is treated as a single management unit in the land capability and prime farmland columns.
** Where drained and either protected from flooding or not frequently flooded during the growing season.
*** Where drained.

# NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.




U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF SOIL AND WATER CONSERVATION
OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER

# GENERAL SOIL MAP

## BROWN COUNTY, OHIO

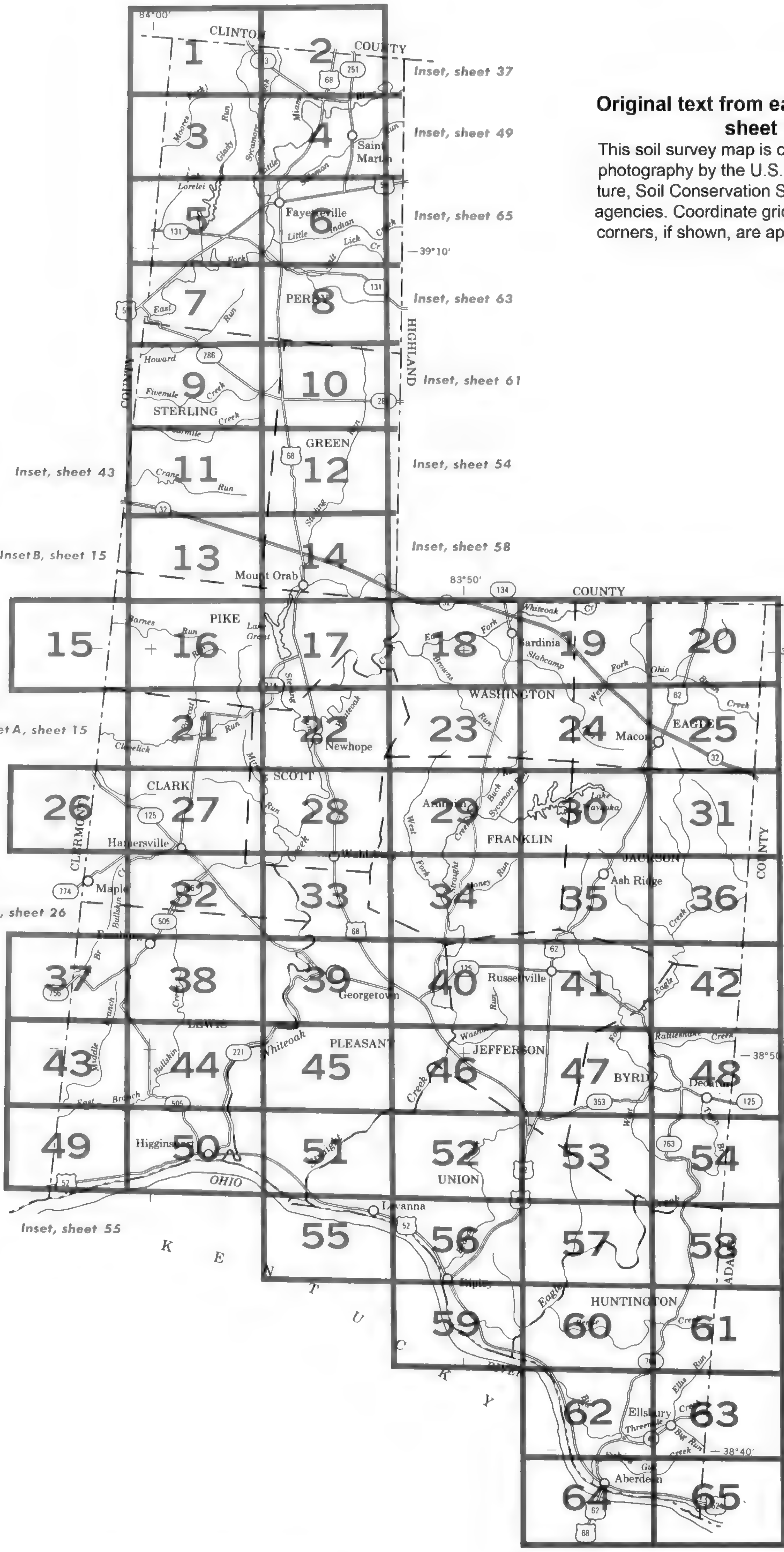
Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

**Original text from each individual map sheet read:**
This soil survey map is compiled on 1982 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.




# INDEX TO MAP SHEETS

BROWN COUNTY, OHIO

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

## SOIL LEGEND

Map symbols consist of a combination of letters or of letters and numbers. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter, except that it does not separate sloping or eroded phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 indicates the soil is eroded, and a number of 3 indicates it is severely eroded.

| SYMBOL | NAME |
|---|---|
| Ag | Algiers silt loam, frequently flooded |
| AtC2 | Atlas silty clay loam, 6 to 12 percent slopes, eroded |
| AvA | Avonburg silt loam, 0 to 2 percent slopes |
| AwB2 | Avonburg-Atlas complex, 2 to 6 percent slopes, eroded |
| Bc | Blanchester silt loam |
| BoD2 | Bonnell silt loam, 15 to 25 percent slopes, eroded |
| BoE | Bonnell silt loam, 25 to 40 percent slopes |
| BoF | Bonnell silt loam, 40 to 60 percent slopes |
| BrD3 | Bonnell silty clay loam, 15 to 25 percent slopes, severely eroded |
| ChF | Chili loam, 35 to 70 percent slopes |
| CnC2 | Cincinnati silt loam, 6 to 12 percent slopes, eroded |
| Ct | Clermont silt loam |
| EaE | Eden flaggy silt loam, 25 to 40 percent slopes |
| EaF | Eden flaggy silt loam, 40 to 70 percent slopes |
| EkB | Elkinsville silt loam, 2 to 6 percent slopes |
| EkC2 | Elkinsville silt loam, 6 to 12 percent slopes, eroded |
| FdD2 | Faywood silt loam, 15 to 25 percent slopes, eroded |
| FeC2 | Faywood-Lowell silt loams, 8 to 15 percent slopes, eroded |
| Ge | Genesee silt loam, occasionally flooded |
| JeC2 | Jessup silt loam, 8 to 15 percent slopes, eroded |
| JeD2 | Jessup silt loam, 15 to 25 percent slopes, eroded |
| Ju | Jules silt loam, frequently flooded |
| LoB2 | Loudon silt loam, 3 to 8 percent slopes, eroded |
| LwB2 | Lowell silt loam, 3 to 8 percent slopes, eroded |
| No | Nolin silt loam, occasionally flooded |
| PaC2 | Pate silty clay, 8 to 15 percent slopes, eroded |
| PaD2 | Pate silty clay, 15 to 25 percent slopes, eroded |
| PaE2 | Pate silty clay, 25 to 35 percent slopes, eroded |
| RpB | Rossmoyne silt loam, 1 to 6 percent slopes |
| RpC2 | Rossmoyne silt loam, 6 to 12 percent slopes, eroded |
| RwC3 | Rossmoyne-Bonnell complex, 6 to 12 percent slopes, severely eroded |
| SaB | Sardinia silt loam, 1 to 6 percent slopes |
| ScA | Sciotoville silt loam, 0 to 2 percent slopes |
| Sh | Shoals silt loam, frequently flooded |
| WvB | Williamsburg silt loam, 2 to 6 percent slopes |

## CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

### CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Davis Airstrip; FLOOD POOL LINE

STATE COORDINATE TICK

ROADS

- Divided (median shown if scale permits)
- Other roads

ROAD EMBLEMS & DESIGNATIONS

- Federal — 410
- State — 52
- County — Named

RAILROAD

DAMS

- Large (to scale)

PITS

- Gravel pit
- Mine or quarry

### WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end

LAKES, PONDS AND RESERVOIRS

- Perennial — water

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Wet spot

### SPECIAL SYMBOLS FOR SOIL SURVEY

- SOIL DELINEATIONS AND SYMBOLS — Sh Ge
- SHORT STEEP SLOPE
- DEPRESSION OR SINK
- SOIL SAMPLE SITE — S

MISCELLANEOUS

- Gravelly spot
- Sanitary Landfill

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 1

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 2

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 3

(Joins sheet 1)


4
N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
0.5
1/2
3/4
(Joins sheet 2)
(Joins sheet 3)
(Joins sheet 6)
(Joins inset, sheet 4?)
1 595 000 FEET
Sycamore Creek
Sycamore Cr.
West Fork
East Fork
Little Miami River
East Fork Little Miami River
Anderson Run
Solomon Run
Solomon
Run
water
BLACK ROAD
MORGAN ROAD
PARK ROAD
BROWN COUNTY INN ROAD
SAVAGE ROAD
KELLEY ROAD
STATE ROAD
ROAD
P E R R Y
St Martin
68
123
251
AvA
BoD2
BoE
BrD3
Ct
EaF
Ge
JeC2
JeD2
RpB
RpC2
RwC3
SaB
Sh
WvB
AwB2

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 5

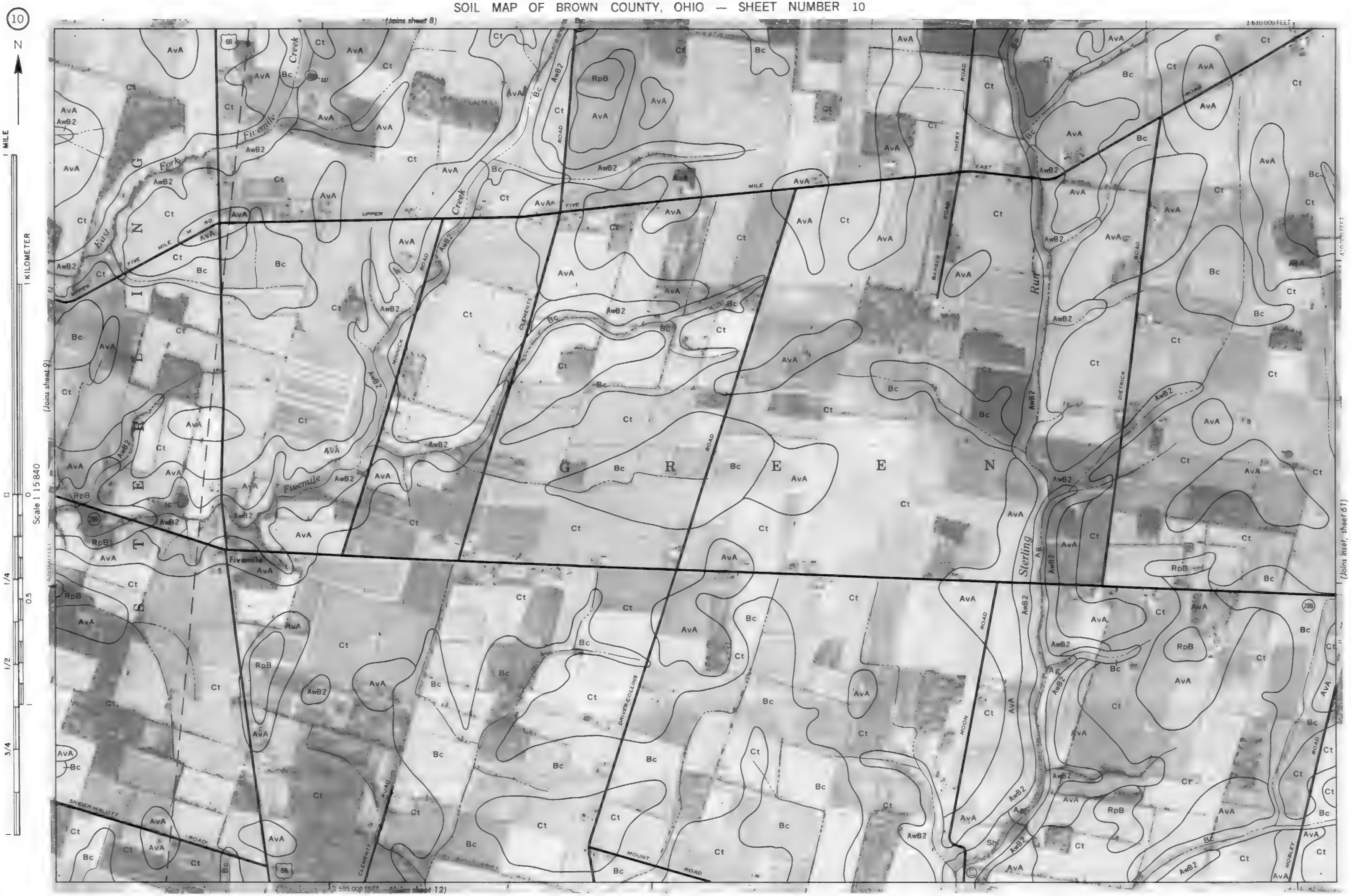

6
N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
0.5
1/2
3/4
1
(Joins sheet 4)
(Joins sheet 5)
(Joins sheet 8)
(Joins inset, sheet 65)
1 610 000 FEET
1 595 000 FEET
Fayetteville
P E R R Y
E Fk L Miami R
Little Miami River
East Fork
Solomon
Murray Run
Little Indian Creek
Indian Creek
Saltlick Creek
Creek
STATE ROAD
ANDERSON
FAYETTEVILLE
BLANCHESTER
SNOWHILL ROAD
MURRAY CORNER ROAD
CORNER ROAD
CAMPBELL ROAD
TURNER ROAD
CARLIER ROAD
DENNING ROAD
SMITH ROAD
STYKES ROAD
EVANS RD
50
88
131
251

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 7

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 8

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 9

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 10



SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 11

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 12


13
N
(Joins sheet 11)
(Joins sheet 14)
(Joins sheet 16)
(Joins inset B, sheet 16)
1 575 000 FEET
1 590 000 FEET
385 000 FEET
375 000 FEET
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
S T E R L I N G
P I K E
Eastwood
Bodman
GREENBUSH
COBB ROAD
HESS ROAD
NORFOLK
EASTWOOD ROAD
LINDSEY ROAD
BODMAN ROAD
BARDWELL
WEST ROAD
WESTERN
TRI-COUNTY HIGHWAY
OLD NO. 74
OLD SALEM CHURCH ROAD
STATE
HARMONY ROAD
NEW HARMONY
SALEM ROAD
NEW
TODD RUN
MAPLE GROVE ROAD
UPPER CUMBERLAND ROAD
BROOKS-MALOTT
BOYD ROAD
CARPENTER ROAD
OLD STATE RD
HIGHWAY
Todd Run
Indian Camp Run
Plum Creek
Water
AvA
AwB2
Bc
BoD2
Ct
Ge
RpB
RpC2


14
N
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:15 840
AvA (Joins sheet 12)
(Joins sheet 13)
(Joins inset, sheet 58)
1 610 000 FEET
595 000 FEET
G R E E N
P I K E
Bardwell
MOUNT ORAB
STERLING
HIGHLAND COUNTY
BARDWELL ROAD
BUFORD ROAD
WEST ROAD
NORFOLK
WESTERN
CRAWFORD-DAY ROAD
HILLCREST ROAD
BROOKS
DAY ROAD
CARPENTER
PLEASANT HILL ROAD
KLEIN ROAD
Yellow Run
Sterling Run
White Oak Creek
North Fork
water
AvA
AwB2
Ct
RpB
RpC2
Sh
BoD2
Bc
BoE
SaB
Ge
Ag
WvB

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 15

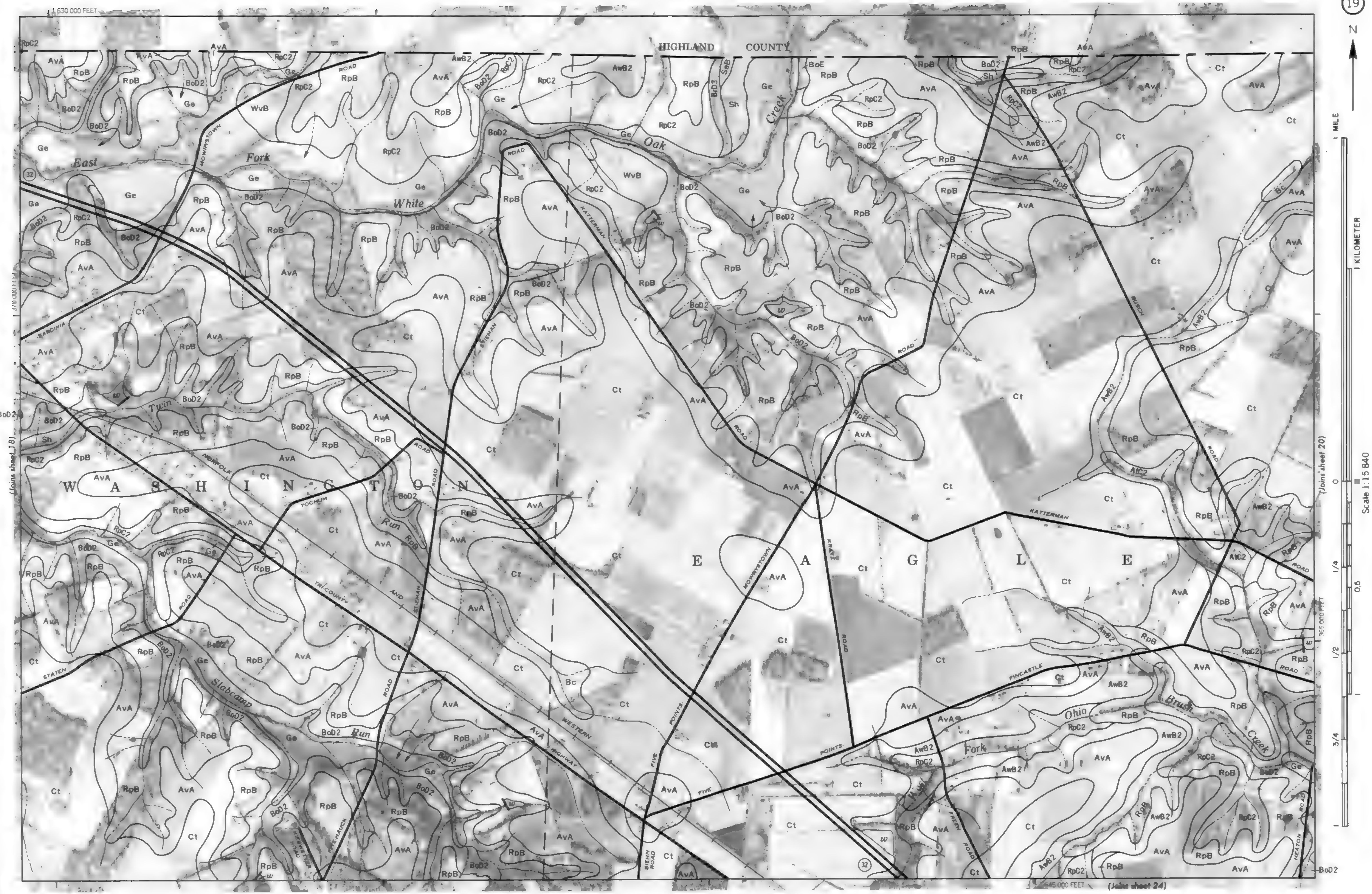
16


(Joins sheet 13)
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 21)
N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
1
0.5
1 590 000 FEET
1 575 000 FEET
P I K E
MAPLE GROVE ROAD
NEW HARMONY ROAD
SALEM ROAD
UPPER CUMBERLAND ROAD
SHILOH ROAD
BUTTS ROAD
OLD BOYD ROAD
PLEASANT ROAD
Plum Creek
Barnes Run
CUMBERLAND ROAD
LOWER CUMBERLAND
GARGONIA ROAD
LOCUST RIDGE ROAD
KRESS ROAD
Locust Ridge
Light Run
OAKLAND
VAN THOMPSON RD
LIMING
Polecat
ROBINSON ROAD
NEW HARMONY
Shiloh
NEAL ROAD
Run


17
(Joins sheet 14)
(Joins sheet 16)
(Joins sheet 18)
(Joins sheet 22)
N
WASHINGTON
P I K E
W A S H I N G T O N
S C O T T
LAKE
GRANT
Plum
Cr
Walton
Pond
Turtle
Run
Snapping
Sterling
Run
White
Oak
Creek
N Fk White Oak Cr
E Fk White Oak Cr
White Oak
OAKLAND
ROAD
OAKLAND-LOCUST RIDGE RD
CARPENTER
PLEASANT
HILL
LAKE
GRANT
NORFOLK
TRI-COUNTY
CANYON
HIGHWAY
WESTERN
STATION
BRANNON
BECKELHEIMER RD
STEPHAN
68
774
MILE
KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
1
Ct
AvA
RpB
BoD2
RpC2
Sh
Bc
AwB2
BoE
BoF
Ge
SaB
WvB
EaE
EaF


(Joins inset, sheet 58)
HIGHLAND COUNTY
W A S H I N G T O N
Sardinia
White Oak
White Oak Creek
North Fork White Oak
East Fork
Middle Run
Slabcamp
Browns Run
Turkey Hole Run
Twin Run
Flat Run
P I K E
S C O T T
CORBOY ROAD
KAY ROAD
BEAN ROAD
NORFOLK AND WESTERN
TRI COUNTY HIGHWAY
MATTHEWS ROAD
SHROUFE RD
WARDLOW
STEPHAN
BARNES ROAD
TRACY ROAD
HAMER
SARDINIA MOWRYSTOWN ROAD
(Joins sheet 17)
(Joins sheet 23)
1 610 000 FEET
1 630 000 FEET
N
1 MILE
1 KILOMETER
Scale 1:15 840

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 19

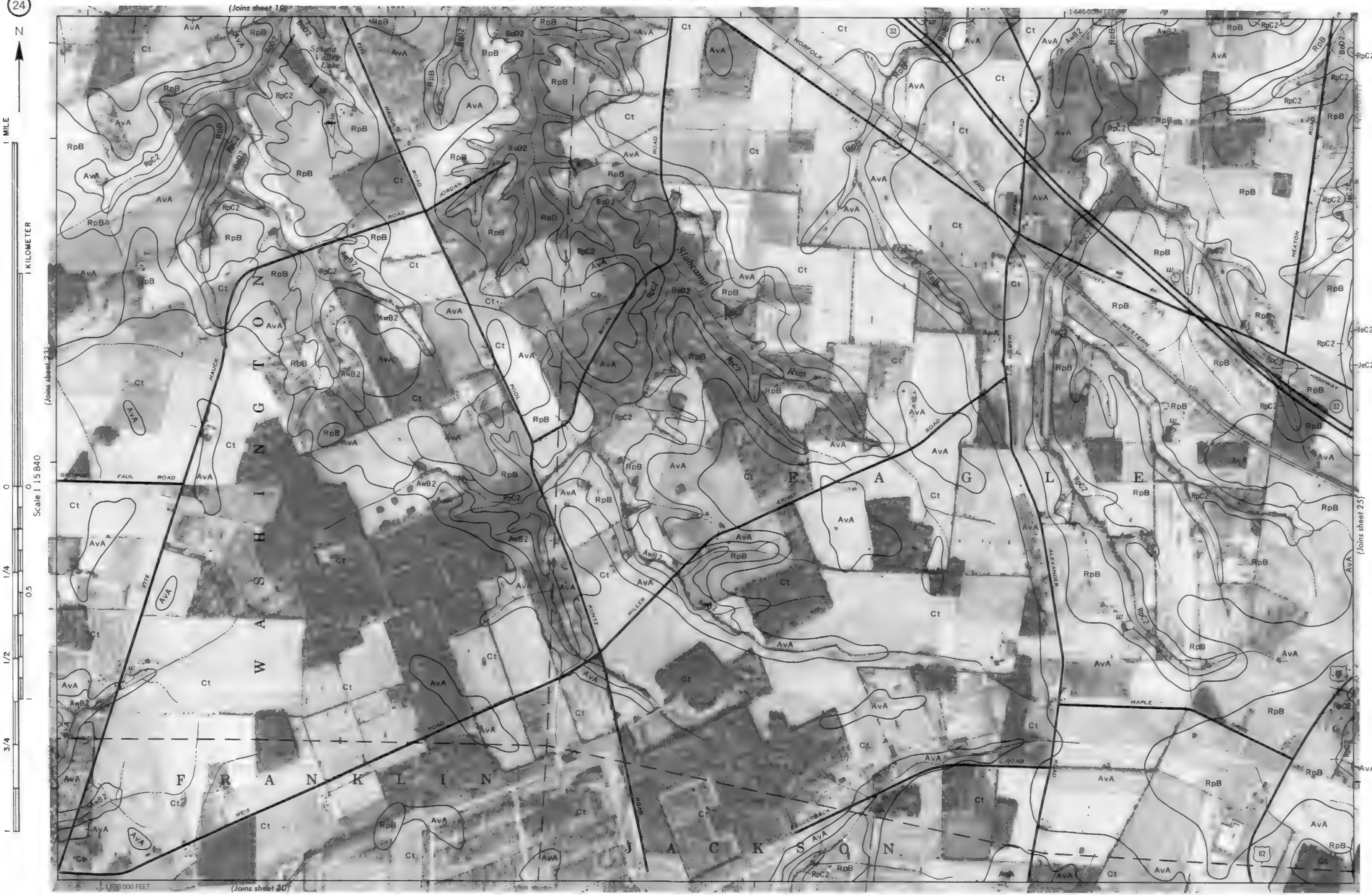



20
N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 19)
1 665 000 FEET
HIGHLAND COUNTY
ADAMS COUNTY
E A G L E
STIVERS ROAD
SHITEPOKE ROAD
OVERSTAKE ROAD
STOUT ROAD
ACKLES ROAD
STEELE ROAD
WILSON ROAD
KATTERMAN ROAD
FIVE POINTS FINCASTLE ROAD
FINCASTLE WINCHESTER ROAD
MOUND ROAD
HEATON ROAD
Fincastle
West Fork Ohio Brush Cr
62
(Joins sheet 25)


21
N
(Joins sheet 16)
(Joins sheet 22)
(Joins sheet 27)
(Joins inset A, sheet 16)
1 575 000 FEET
360 000 FEET
P I K E
C L A R K
S C O T T
STARLING ROAD
THOMPSON ROAD
ROBINSON ROAD
NEW HARMONY SHILOH ROAD
BROOKS CEM ROAD
BETHEL NEW HOPE ROAD
VAN
BOLENDER ROAD
LIMING
STRATTON ROAD
EAST SIDE ROAD
Polecat Run
Cloverlick Creek
Creek
Miranda Run
Neals Corner
774
1 MILE
1 KILOMETER
Scale 1:15 840


22
N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 21)
(Joins sheet 23)
(Joins sheet 28)
1 595 000 FEET
P I K E
S C O T T
F R A N K L I N
WASHINGTON
New Hope
Sterling Run
White Oak Creek
Goose Run
KIMBALL ROAD
BINGAMON ROAD
STATION ROAD
STERLING ROAD
DAIRY LANE
NEW HOPE ROAD
GOOSE RUN ROAD
WHITE OAK ROAD
HOPE McKINLEY ROAD
BETHEL NEW HOPE ROAD
FITE ROAD
STONY HOLLOW ROAD
774
68


23
N
(Joins sheet 18)
(Joins sheet 24)
(Joins sheet 29)
(Joins sheet 22)
1 610 000 FEET
1 625 000 FEET
MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
1
Brownstown
W A S H I N G T O N
F R A N K L I N
S C O T T
Turkey Hole Run
Browns Run
Middle Run
Ag Run
TRACY ROAD
HAMER ROAD
BARNES ROAD
GOOSE RUN ROAD
CATALPA CORNER ROAD
GEORGE FAUL ROAD
PURDY ROAD
BROWNSTOWN ROAD
ARNHEIM ROAD
STEINMAN ROAD
NEW HOPE-McKINLEY ROAD
WEBER KELCH ROAD
HAUCK ROAD
PITTS ROAD
AvA
AwB2
AlC2
Ag
Bc
BoD2
Ct
Ge
RpB
RpC2
RwC3
Sh

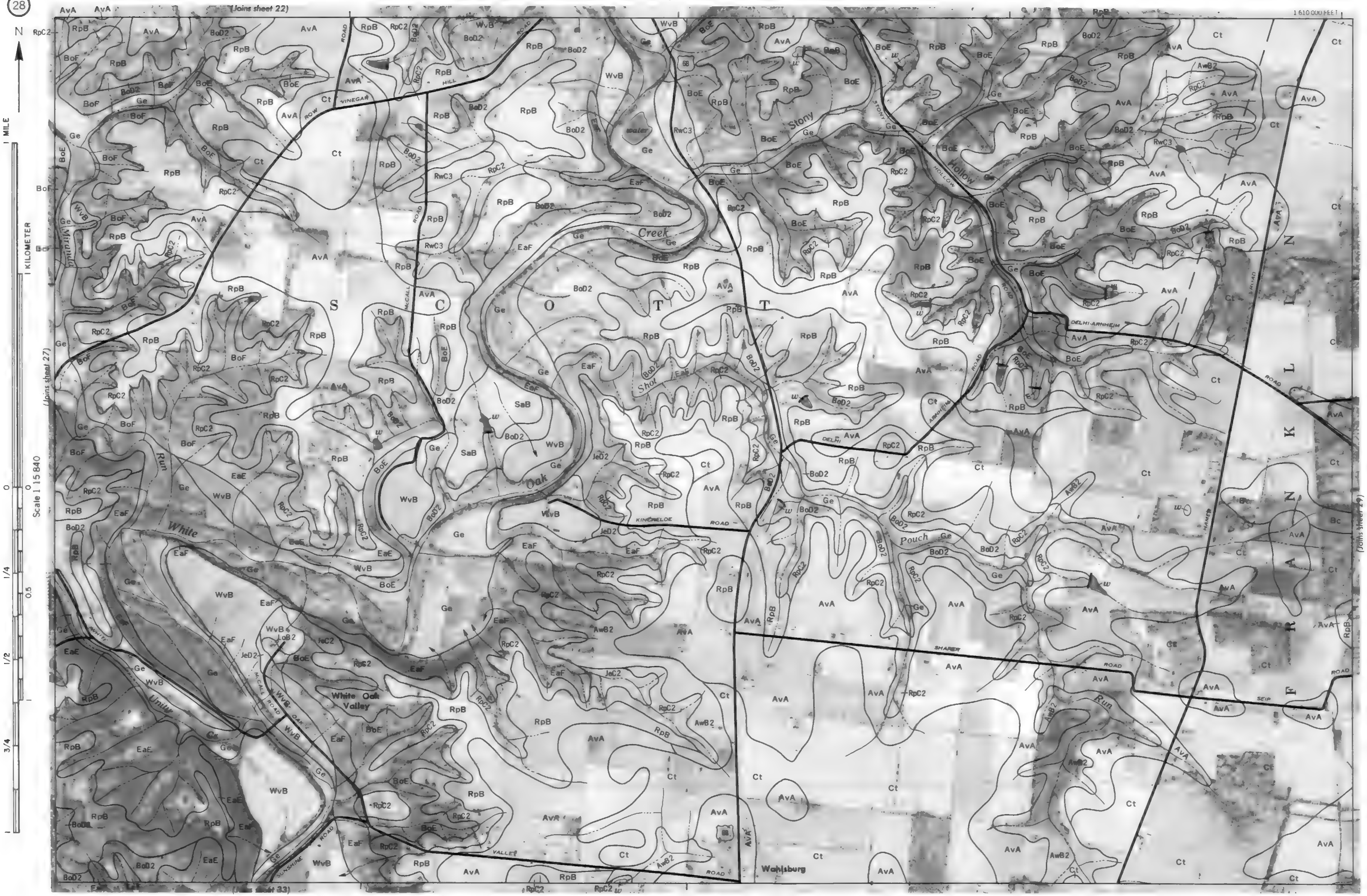

24
N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 19)
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 30)
1 645 000 FEET
1 630 000 FEET
W A S H I N G T O N
E A G L E
F R A N K L I N
J A C K S O N
Spring Valley Lake
Slabcamp Run
NORFOLK AND WESTERN
TRI COUNTY HIGHWAY
JORDAN ROAD
HAUCK ROAD
FAUL ROAD
POOL ROAD
KUNTZ ROAD
MILLER ROAD
ERNST ROAD
ALEXANDER ROAD
MARTIN ROAD
HEATON ROAD
MAPLE DRIVE
WEIS ROAD
LOUDERBACK ROAD
32
62

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 25

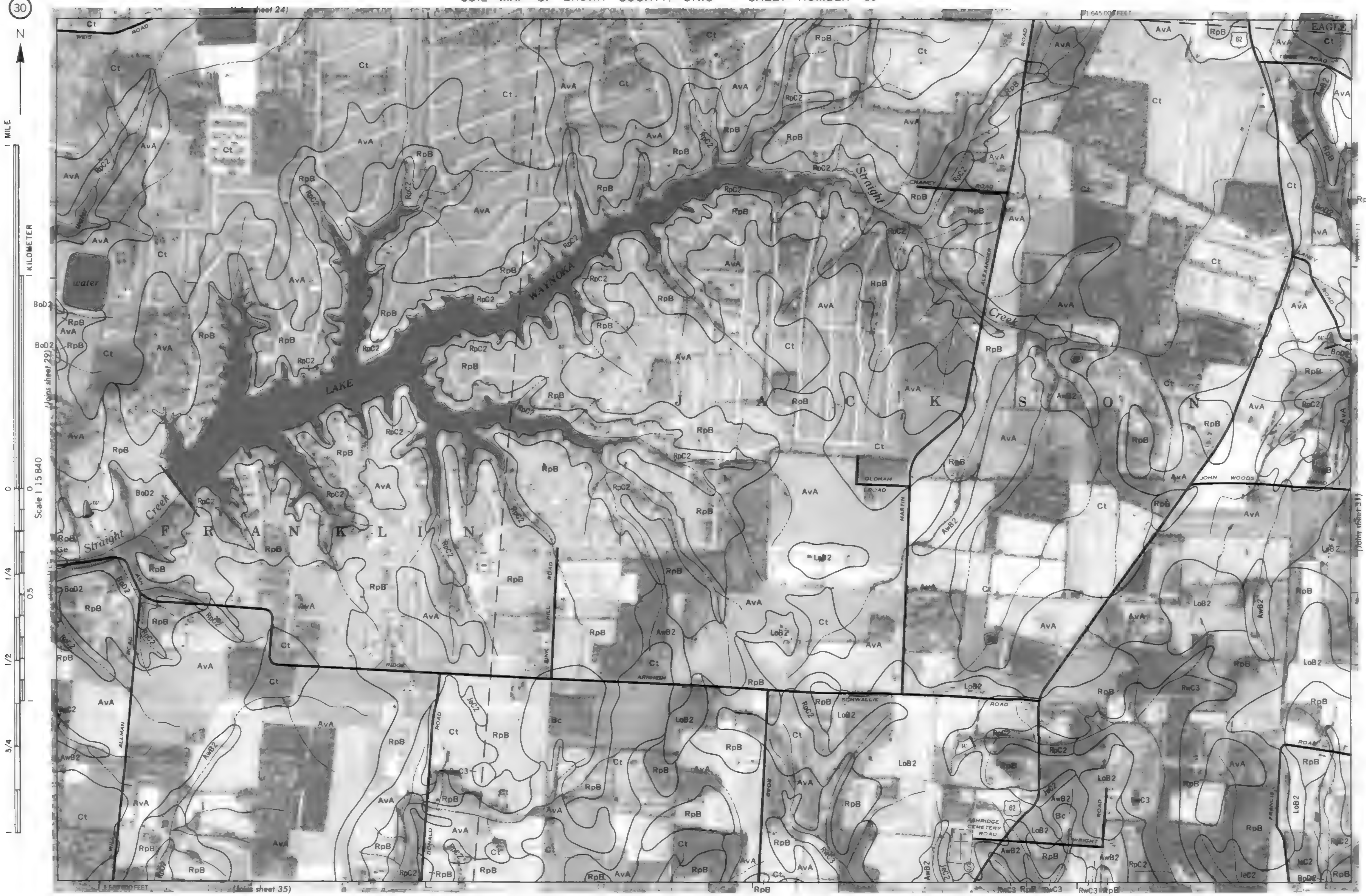

26
N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
1
0.5
1 570 000 FEET
1 565 000 FEET
340 000 FEET
325 000 FEET
(Joins sheet 32)
(Joins sheet 37)
(Joins upper left)
(Joins sheet 27)
C L A R K
L E W I S
CLERMONT COUNTY
Maple
Yankeetown
Bullskin Creek
West Branch
SISTERVILLE
YANKEETOWN ROAD
SODOM ROAD
LIMING LAKE
BLACKSNIP ROAD
LEONARD ROAD
LOVE
VANDAMENT ROAD
ROSE HILL ROAD
DRY ROAD
TRISLER ROAD

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 27

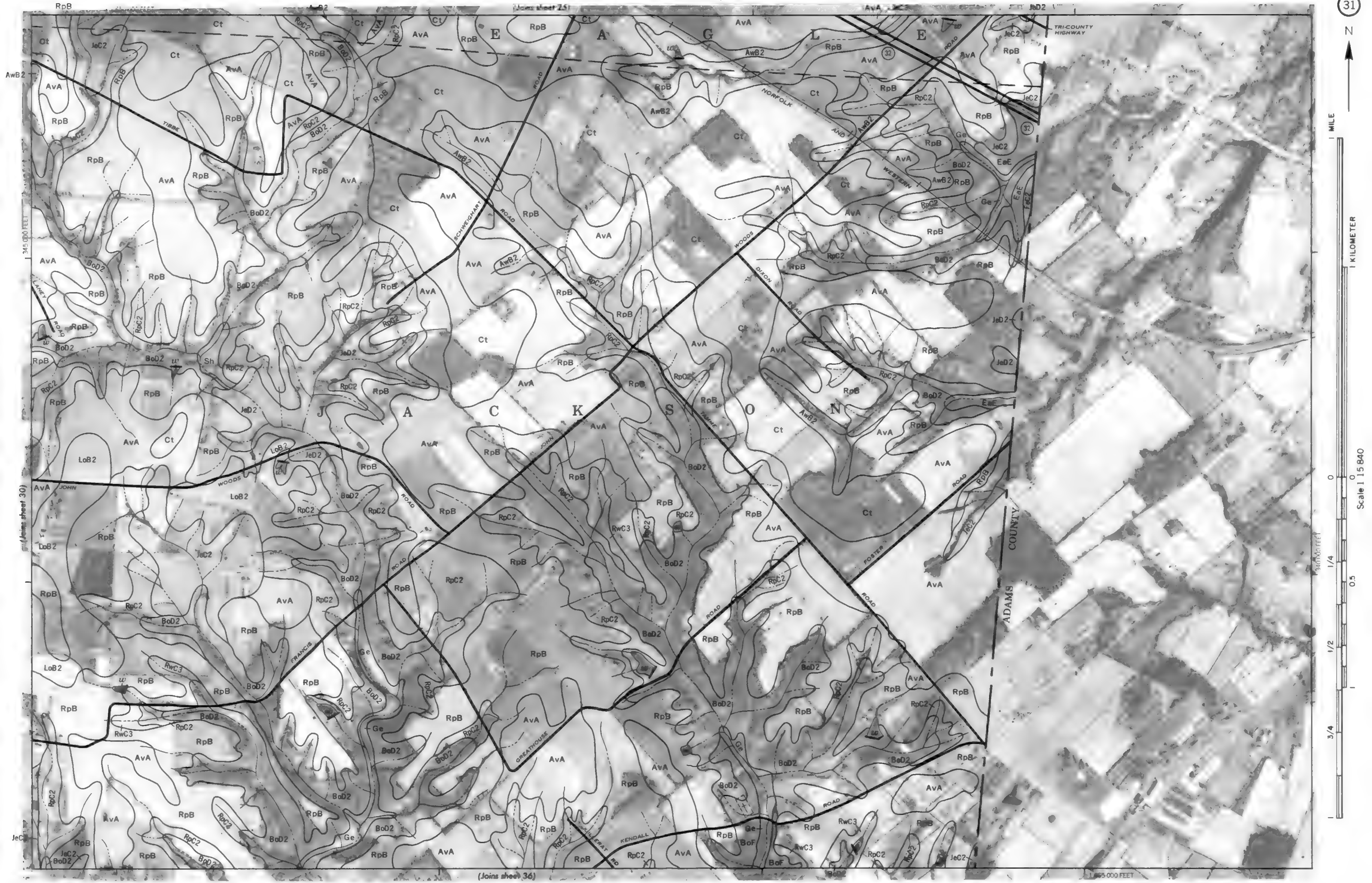
SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 28

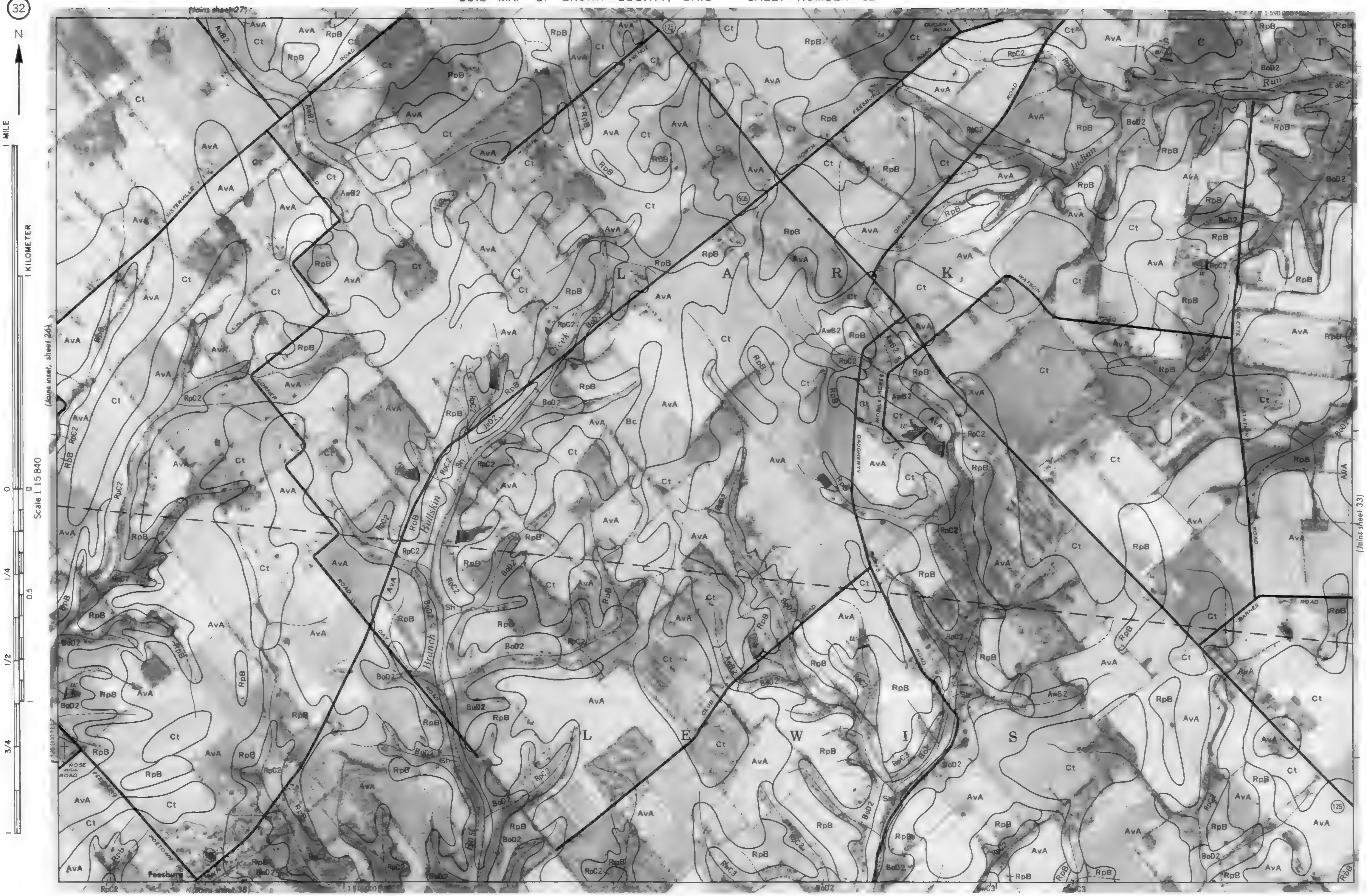



29
N
(Joins sheet 23)
(Joins sheet 28)
(Joins sheet 30)
(Joins sheet 34)
1 610 000 FEET
1 625 000 FEET
F R A N K L I N
Arnheim
Straight
Creek
West
Fork
Sycamore
Black
Run
ARNHEIM ROAD
DELPH
LINDSEY
SEIP ROAD
WEST FORK
STEINMAN
PARKER
BROWNSTOWN
PURDY ROAD
ASH RIDGE
SCHWALLIE ROAD
YOCKEY
HILL ARNHEIM ROAD
WELLS GOECKE ROAD
FITE
HAUCK
TOM SHAW ROAD
ALEX SHAW ROAD
water
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
1
0.5


30
N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 24)
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 35)
1 645 000 FEET
LAKE WAYNOKA
Straight Creek
F R A N K L I N
J A C K S O N
EAGLE
CRANEY ROAD
ALEXANDER ROAD
OLDHAM ROAD
MARTIN
JOHN WOODS ROAD
LANEY ROAD
SCHWALLIE ROAD
ARNHEIM
RIDGE
BINK HILL ROAD
ALLMAN
DONALD ROAD
ASHRIDGE CEMETERY ROAD
WRIGHT ROAD
FRANCIS
62
water
Ct
AvA
RpB
RpC2
BoD2
AwB2
LoB2
JeC2
RwC3
Bc
Ge

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 31




32
N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
(Joins sheet 27)
(Joins sheet 33)
(Joins sheet 38)
(Joins inset, sheet 26)
C L A R K
S C O T T
L E W I S
Feesburg
Bullskin
Creek
Branch
Indian
Run
SISTERVILLE
CORNER
ROAD
DAY
ROAD
NORTH
FEESBURG
DUGAN
ROAD
GRISHAM
WATSON
DAUGHERTY
MOBILE ACRES DR
CLUB
BARNES
ROAD
STATION
ROAD
ROSE HILL ROAD
POETOWN
125
505

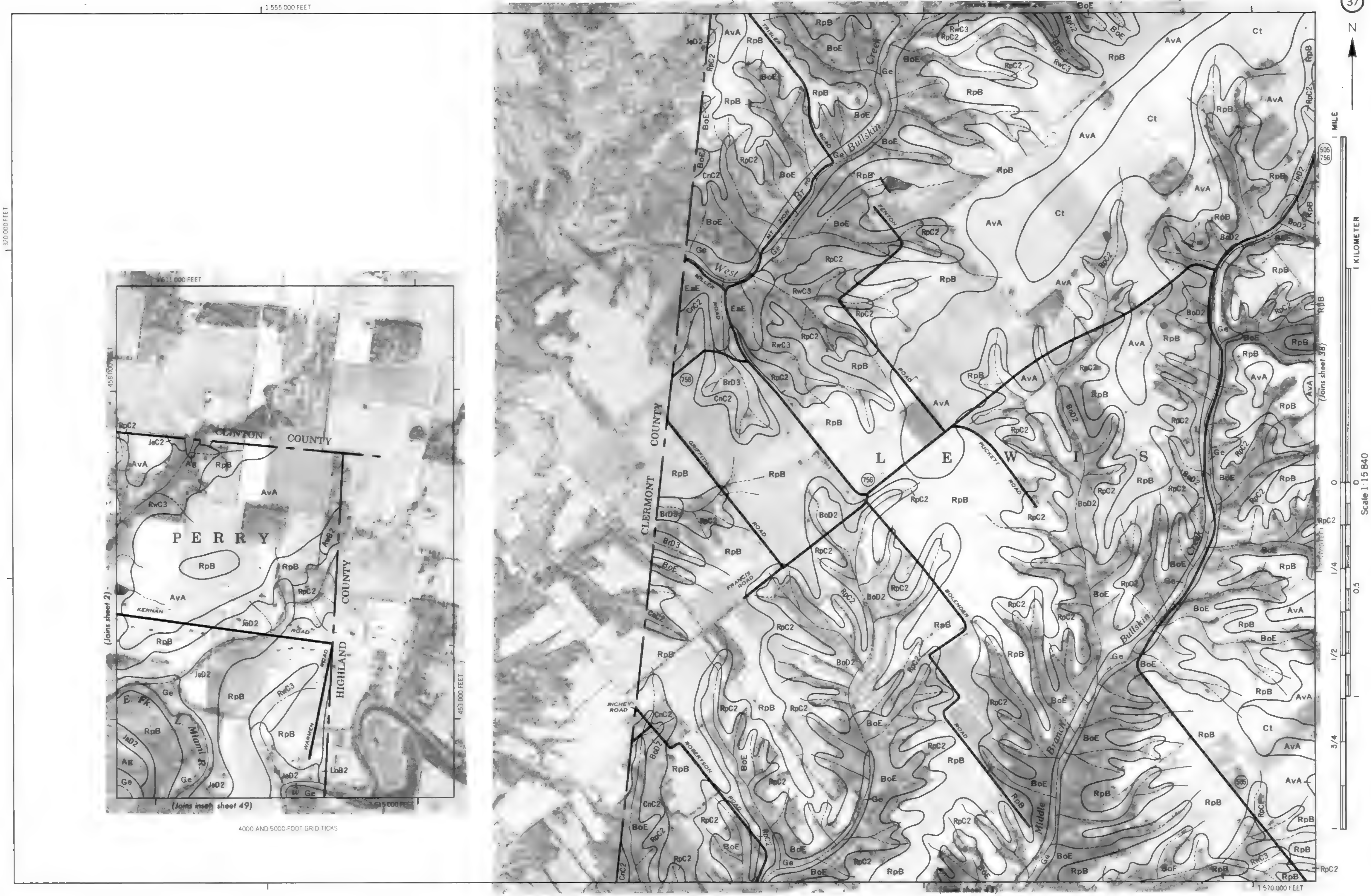
SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 33

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 34


N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
2 630 000 FEET
335 000 FEET
545 000 FEET
(Joins sheet 36)
(Joins sheet 34)
(Joins sheet 41)
FRANKLIN
JACKSON
JEFFERSON
Ash Ridge
YOCKEY ROAD
WILL ALLMAN ROAD
INCLINE ROAD
WALLACE ROAD
CALL ROAD
HONEY RUN ROAD
RISCHFORTH ROAD
RUSSELLVILLE ARNHEIM ROAD
WISHNEY RIDGE
ASH RIDGE ROAD
WINCHESTER ROAD
FRANCIS ROAD
McKOUN ROAD
DOWNING ROAD
White Oak
62
RpB
RpC2
AvA
Ct
BoD2
EaE
AwB2
LoB2
JeC2
JeD2
RwC3
BrD3
BoE
EaF
Ge
Sh

36

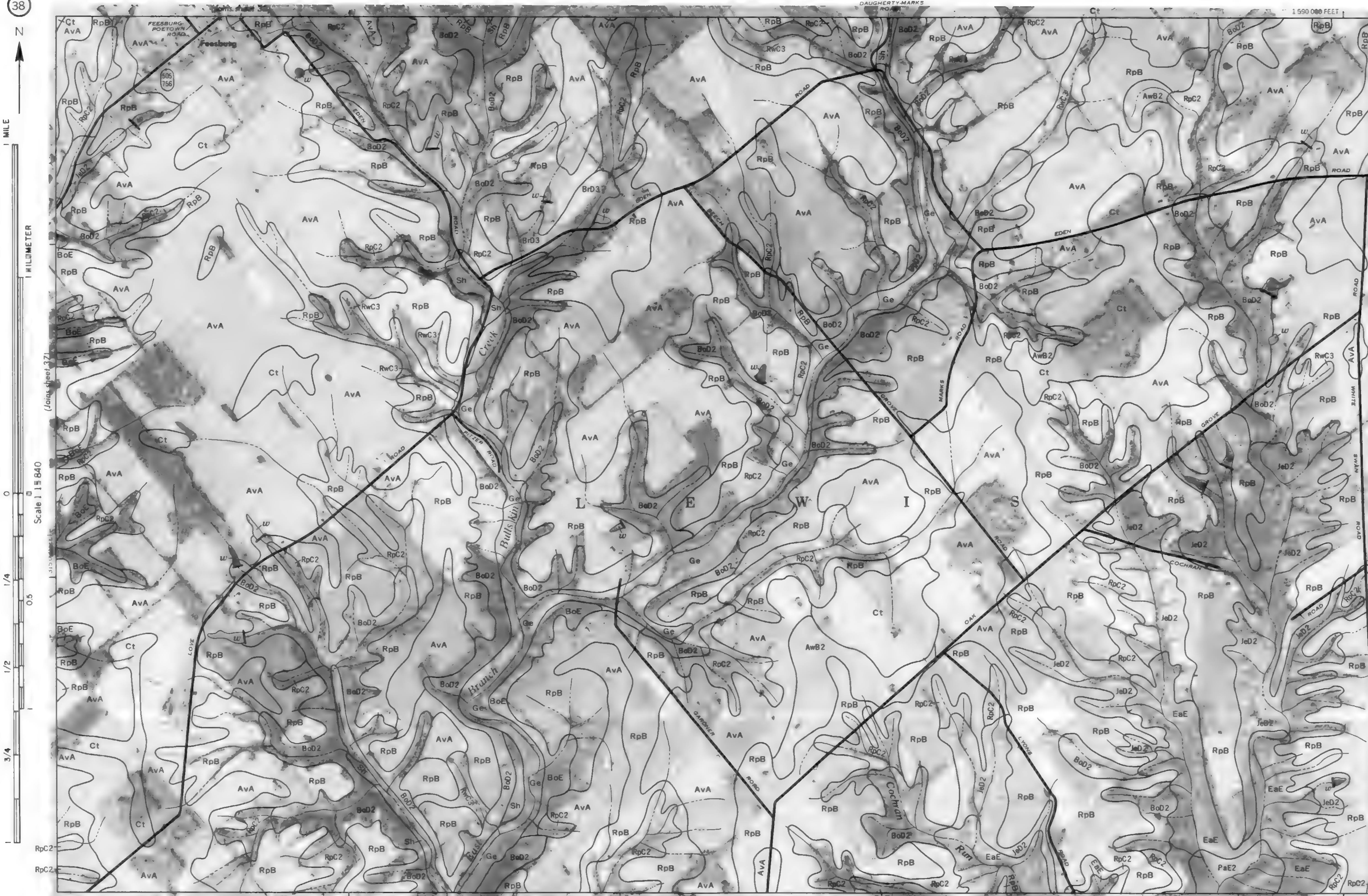
# SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 36

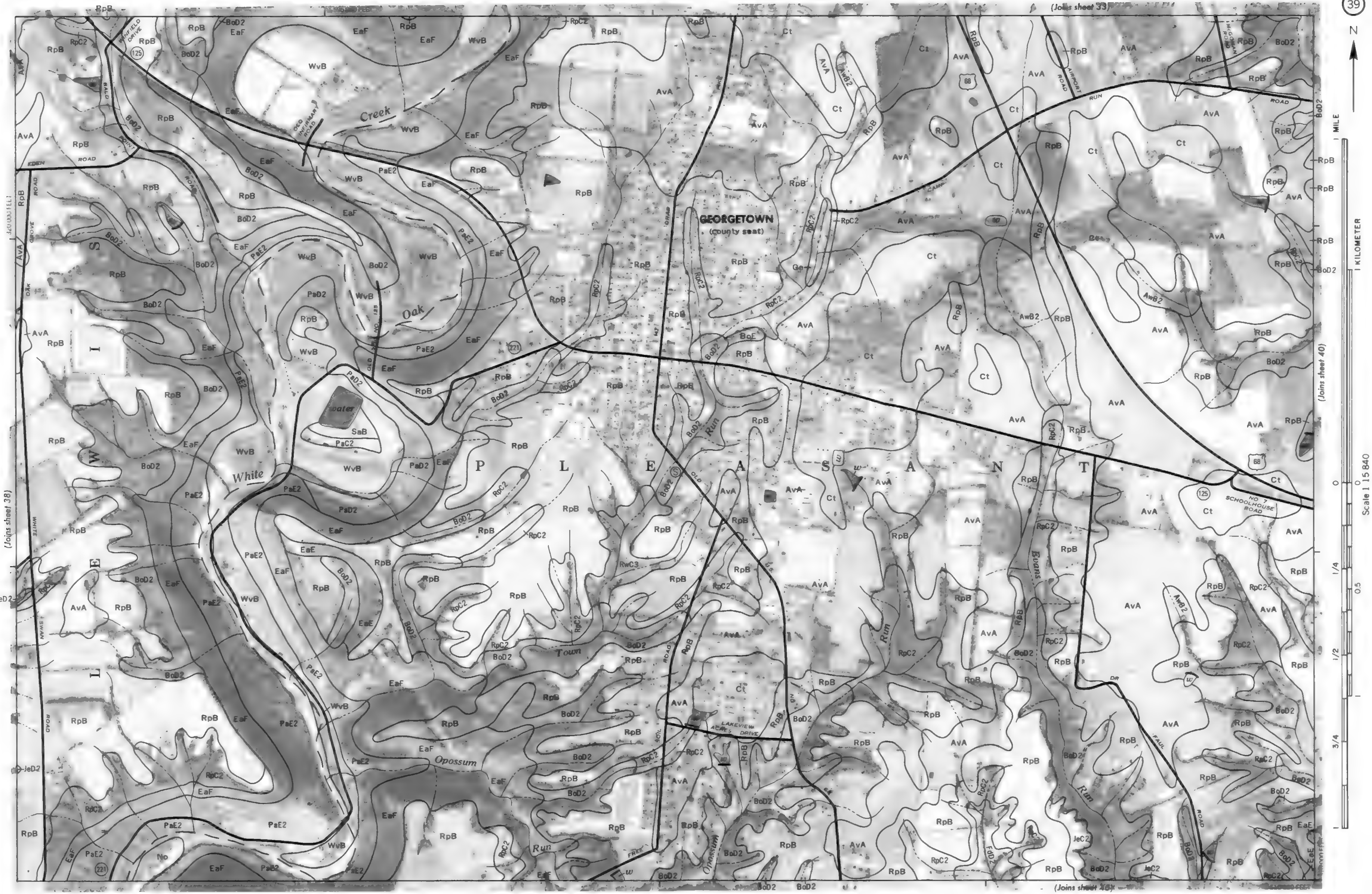


1 555 000 FEET
1 570 000 FEET
LEWIS
PERRY
CLERMONT COUNTY
CLINTON COUNTY
HIGHLAND COUNTY
West Br Bullskin Creek
Middle Branch Bullskin Creek
E. Fk. L. Miami R.
TRISLER ROAD
MT ZION RD
FENTON ROAD
HOLLER ROAD
GRIFFITH ROAD
FRANCIS ROAD
PUCKETT ROAD
BOLENDER ROAD
ROBERTSON ROAD
RICHEY ROAD
KERNAN ROAD
WARMEN ROAD
756
505
(Joins sheet 38)
(Joins sheet 2)
(Joins inset sheet 49)
4000 AND 5000-FOOT GRID TICKS
N
1 MILE
1 KILOMETER
Scale 1:15 840

38

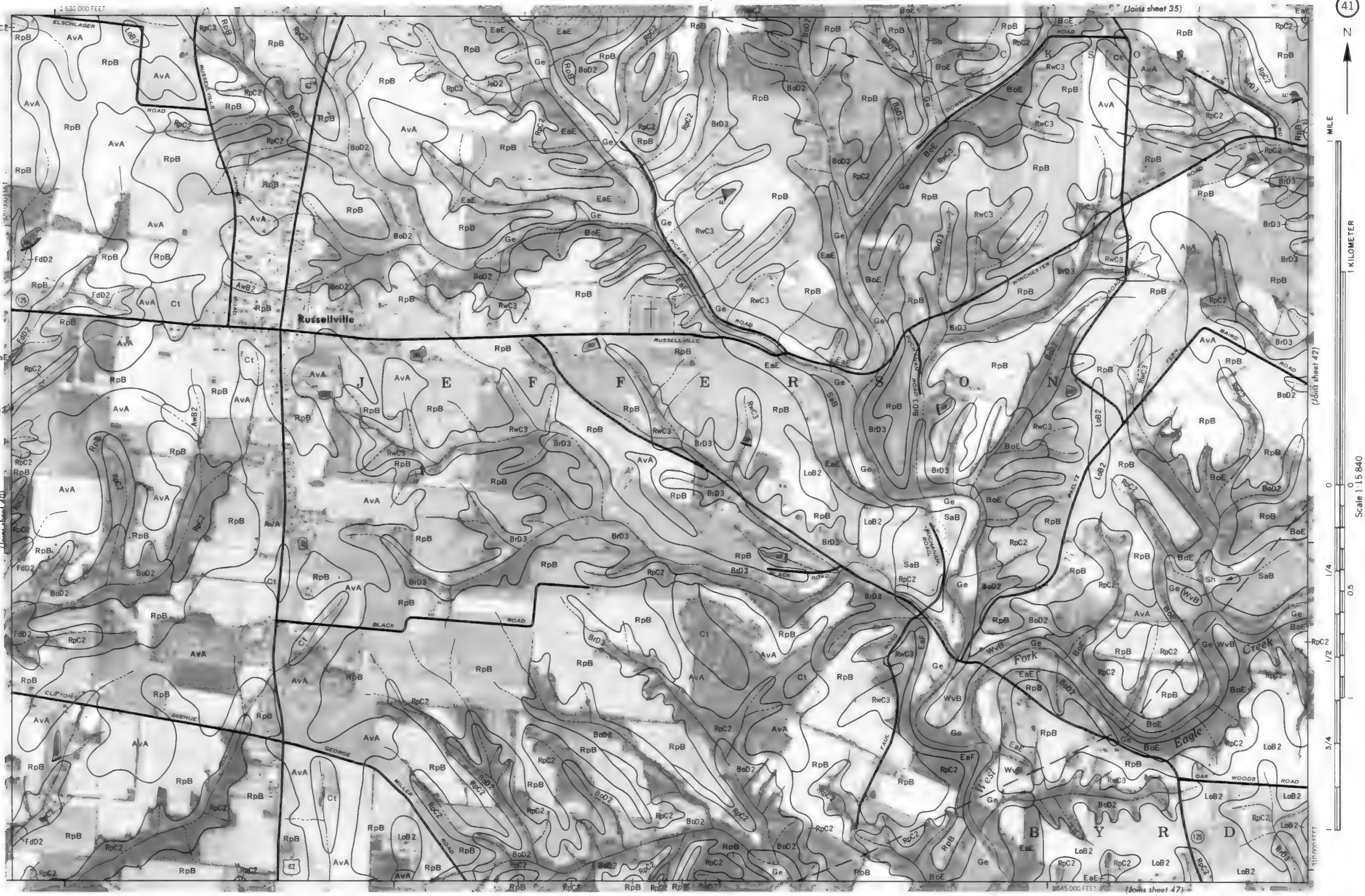
SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 38




(Joins sheet 33)
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 45)
N
GEORGETOWN
(county seat)
P L E A S A N T
W H I T E   O A K
White
Oak
Creek
Town
Run
Opossum
Evans
Run
water
EDEN ROAD
BALD POINT ROAD
WINFIELD DRIVE
OLD INFIRMARY ROAD
AIRPORT ROAD
LAKEVIEW ACRES DRIVE
NO 7 SCHOOLHOUSE ROAD
FAUL ROAD
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
1

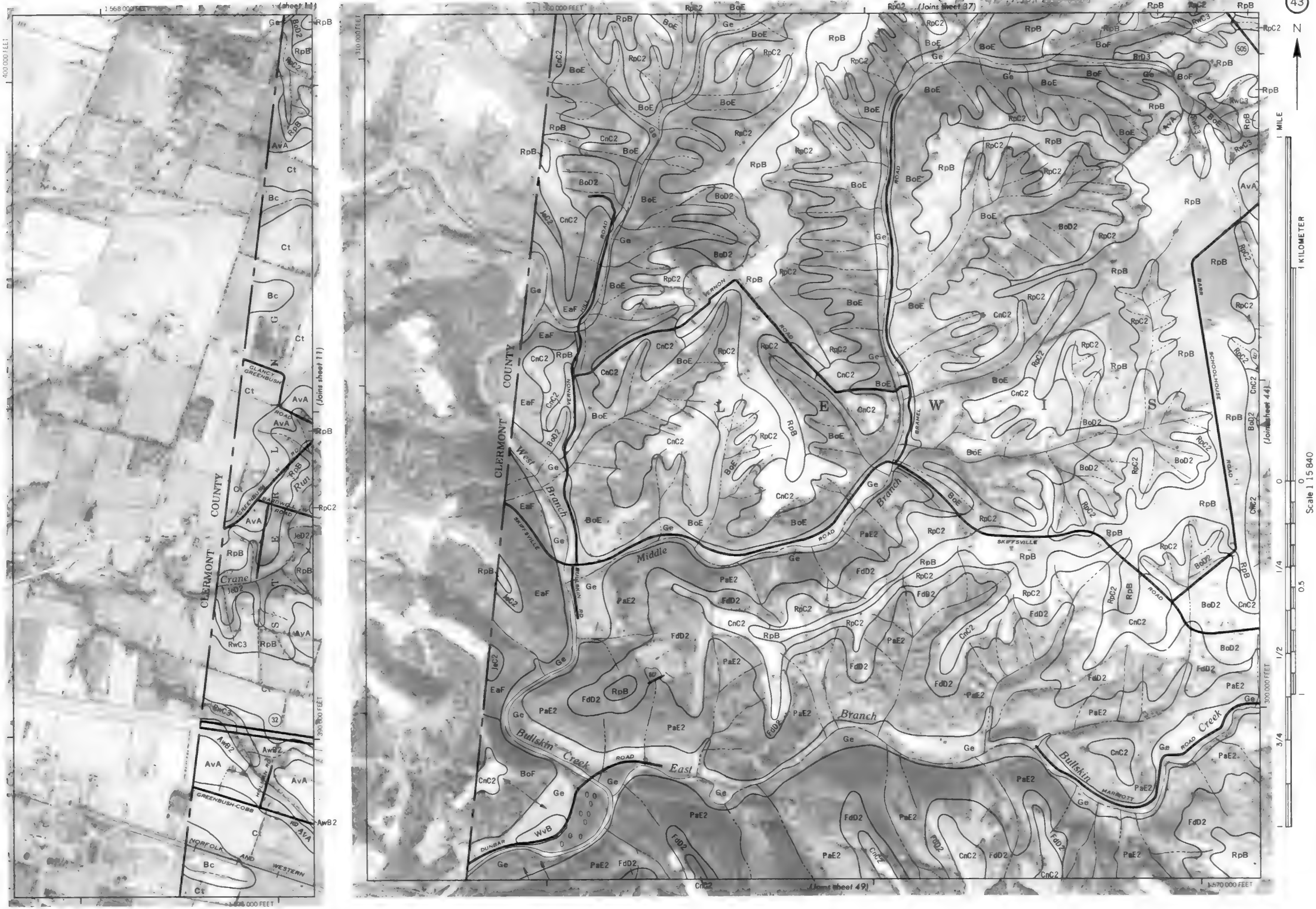

40
N
(Joins sheet 34)
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 46)
1 625 000 FEET
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
1
F R A N K L I N
J E F F E R S O N
P L E A S A N T
Rocky Run
Creek
Myers Run
Run
Camp Run
Straight
Scott
Run
Washburn
Run
NEWMAN ROAD
ARNHEIM ROAD
EDWARDS ROAD
MARTIN HOLLOW ROAD
CAMP RUN ROAD
NO 7 SCHOOLHOUSE ROAD
HILLMAN RIDGE ROAD
MYERS ROAD
ELLIS FARM ROAD
DAY HILL
CONN ROAD
WHITSON ROAD
CLIFTON AVENUE
HOCKMAN ROAD
FRYER ROAD
GAFFIN ROAD
125
68

# SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 41



SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 42

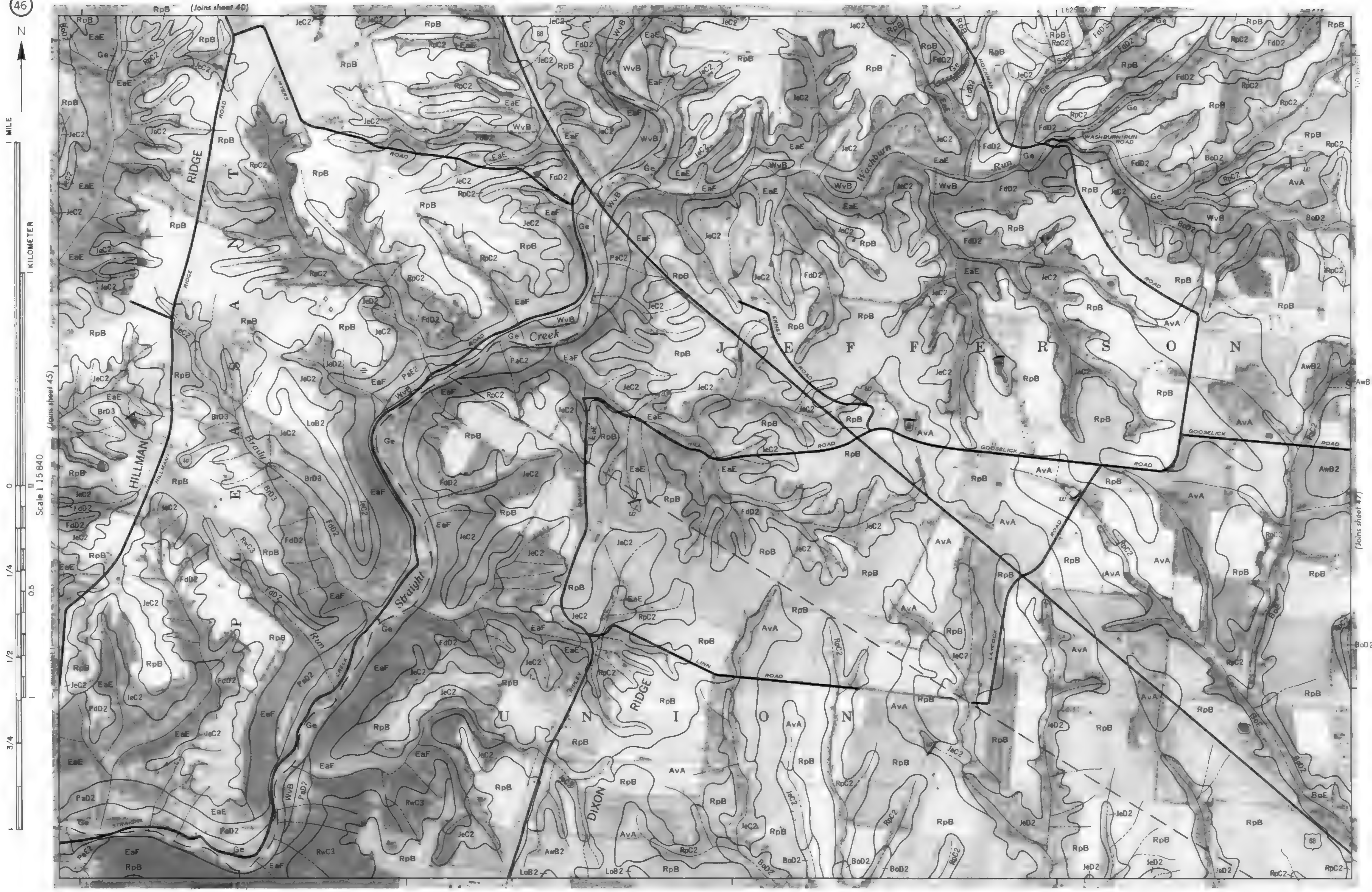
# SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 43



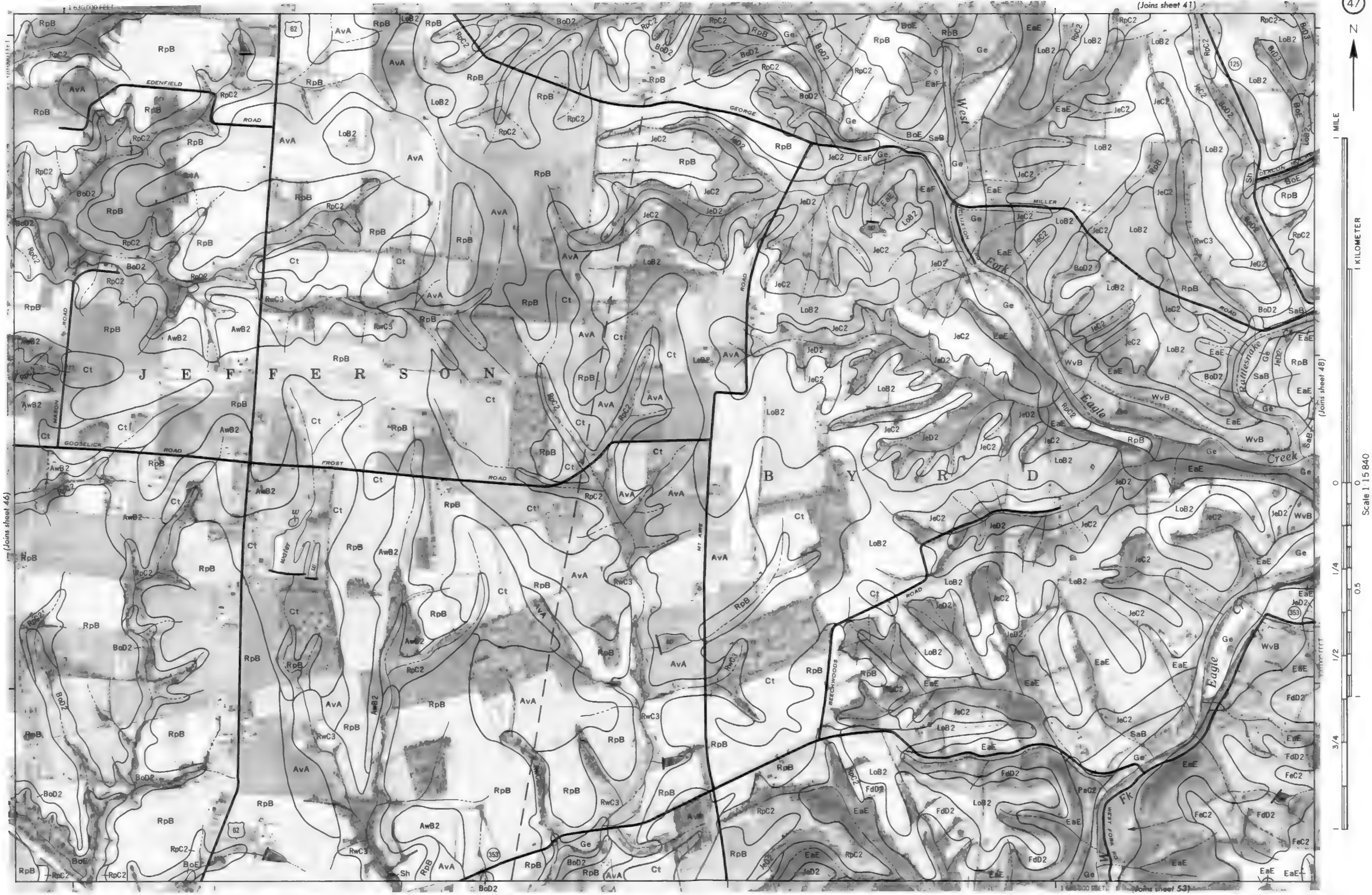
SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 44

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 45

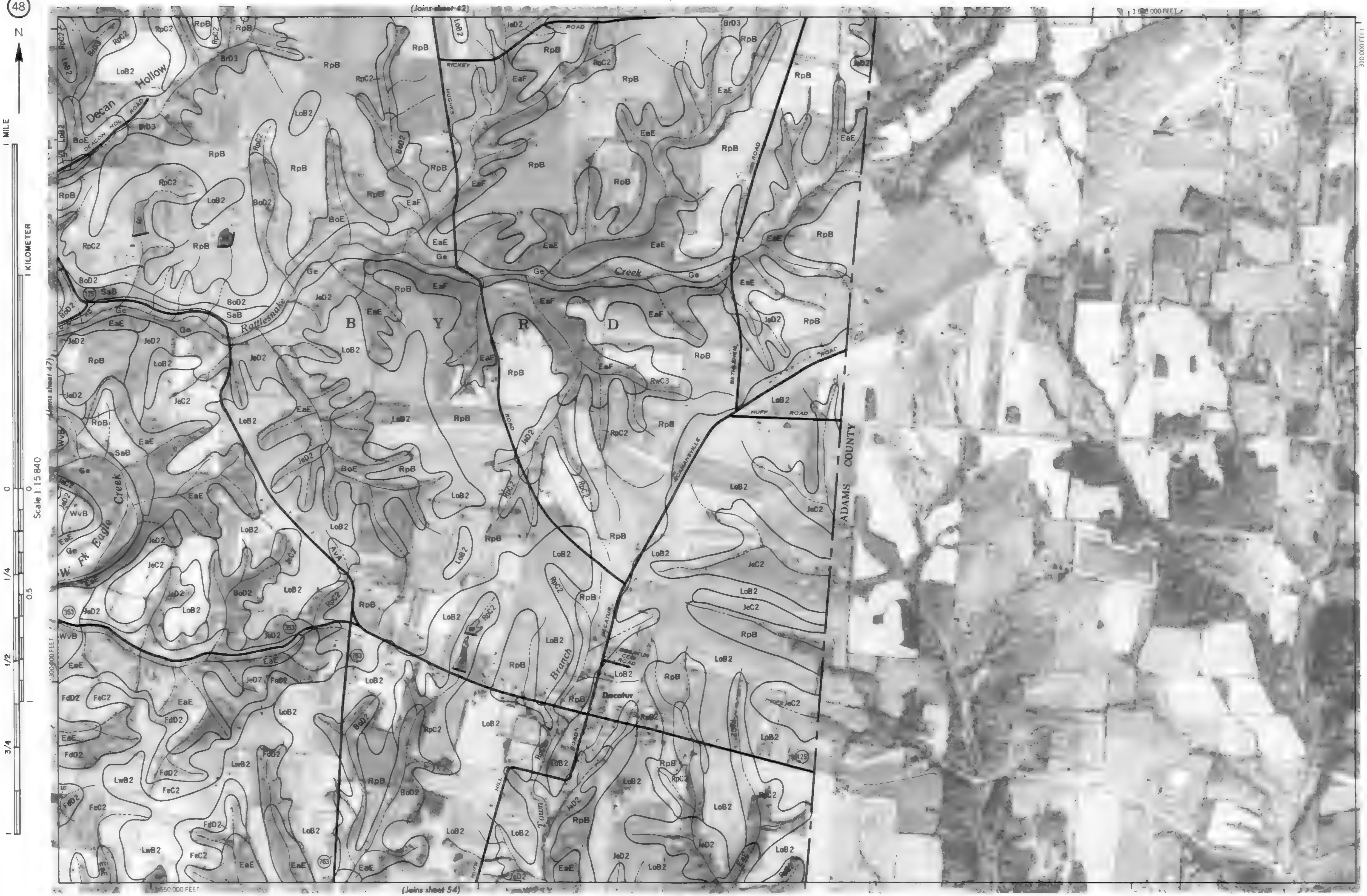
SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 46



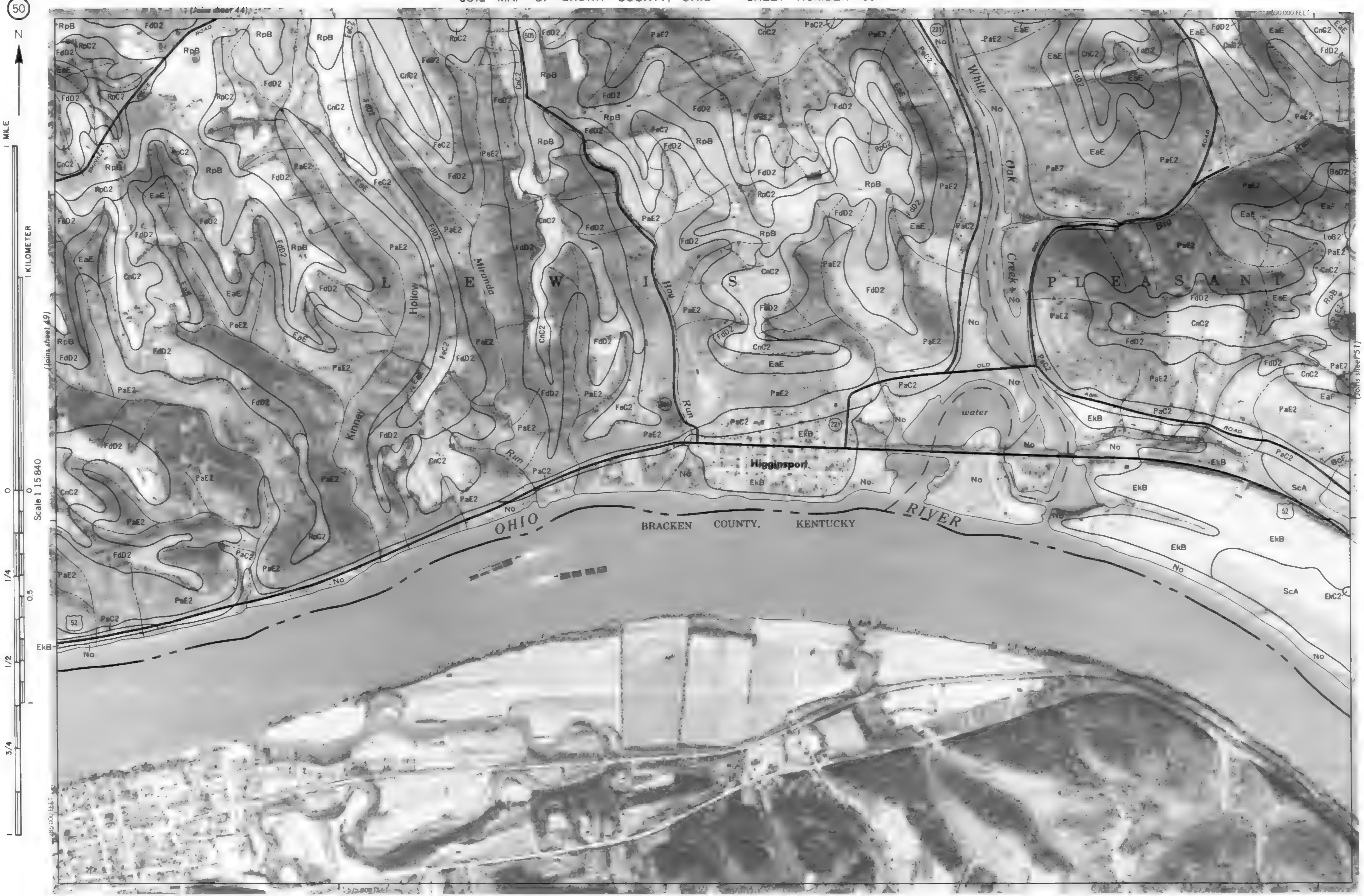
SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 47



SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 48

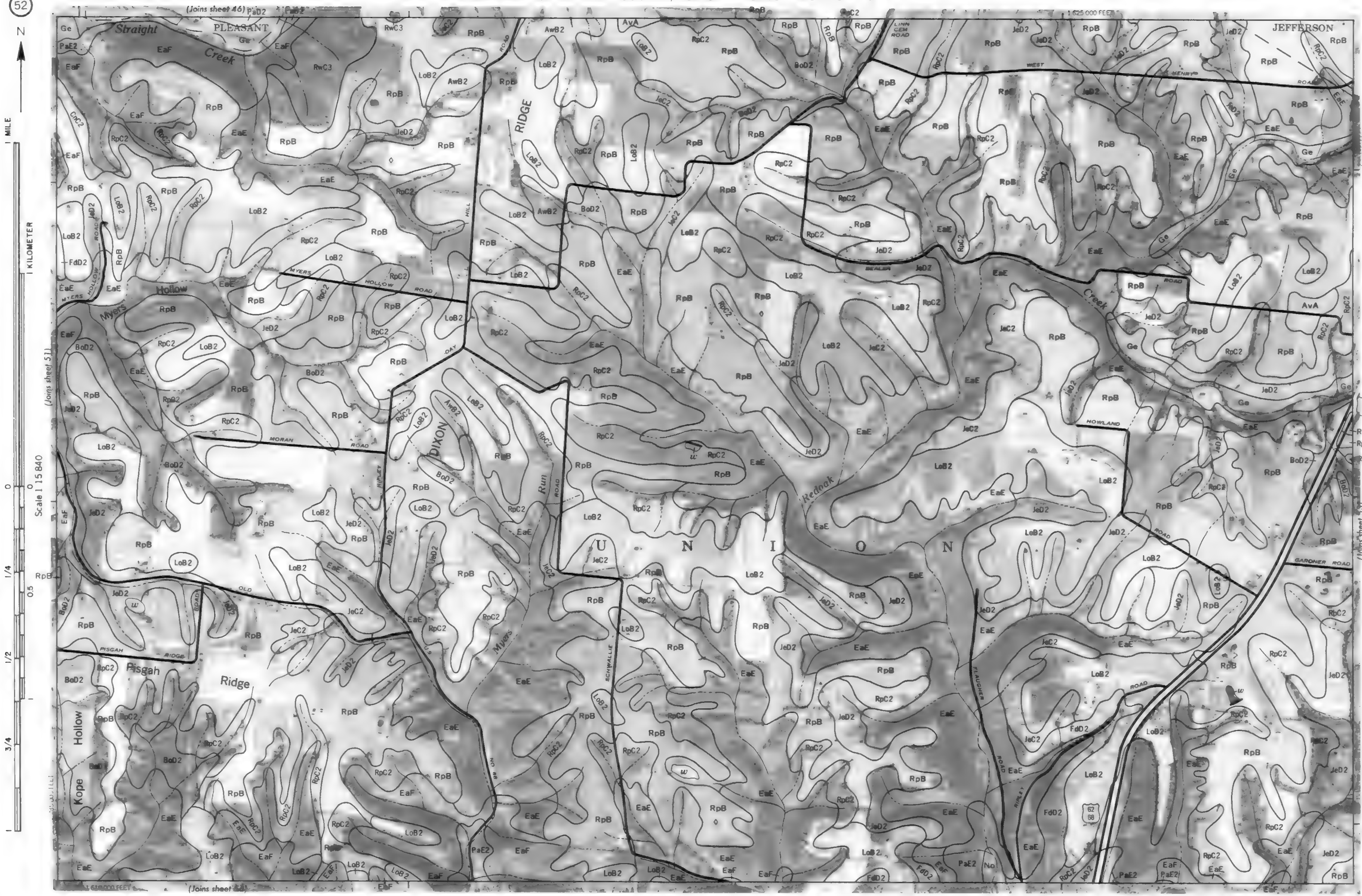



(Joins inset, sheet 37)
(Joins sheet 43)
(Joins sheet 50)
(Joins inset, sheet 65)
N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0
0.5
1 560 000 FEET
1 614 000 FEET
450 000 FEET
440 000 FEET
Bullskin Creek
E. Fk. L. Miami River
EUBANKS ROAD
STATE ROAD
ANDERSON
TAYLOR ROAD
BROWN COUNTY RD
Solomon Run
HIGHLAND COUNTY
CLERMONT COUNTY
PERRY
SHINKLES RIDGE ROAD
HIZER ROAD
BOUDES FERRY ROAD
BUCKEYE
L E W I S
Moon Hollow
THOMAS ROAD
BUCK RUN ROAD
DOE POINT ROAD
Run
Boudes Ferry
OLD U.S. NO. 52
52
OHIO RIVER
BRACKEN COUNTY, KENTUCKY
RpB
Ge
AvA
AwB2
Ct
Bc
EaF
JeD2
WvB
CnC2
FdD2
PaE2
FeC2
PaC2
PaD2
EkB
No
ScA
Sh
EaE
BoF
Ge


N
MILE
KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 44)
(Joins sheet 49)
(Joins sheet 51)
L E W I S
P L E A S A N T
Higginsport
OHIO RIVER
BRACKEN COUNTY, KENTUCKY
Kinney Hollow
Miranda Run
Hog Run
White Oak Creek
Big Run
water
ROAD
OLD ROAD
52
221
505
RpB
RpC2
FdD2
EaE
CnC2
FeC2
PaE2
PaC2
EkB
No
ScA
LoB2
EaF
BoF

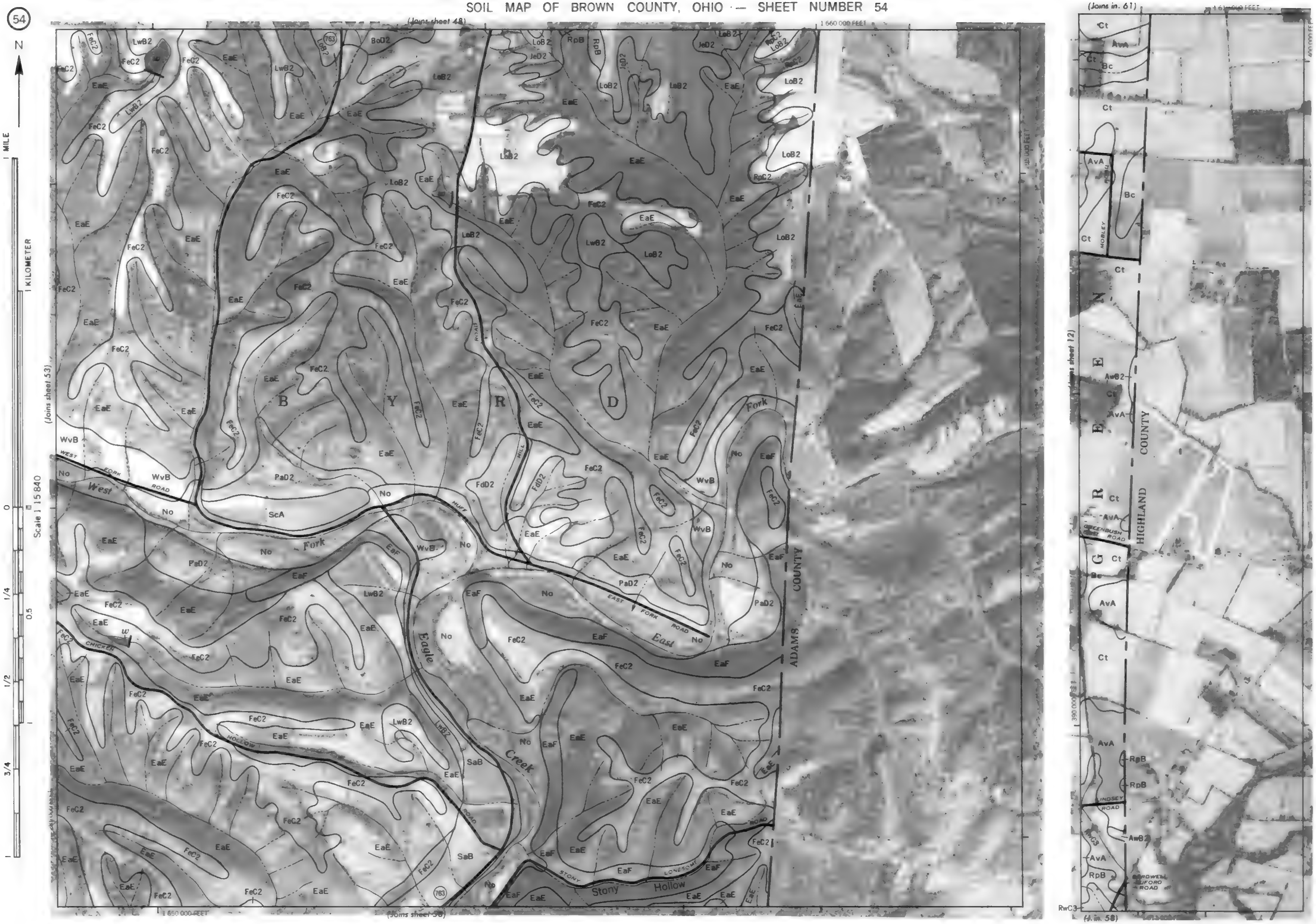

(Joins sheet 45)
(Joins sheet 50)
(Joins sheet 52)
(Joins sheet 55)
1 590 000 FEET
1 605 000 FEET
N
PLEASANT
UNION
Centerpoint
Reeds
Lyon Ridge
Cahall Ridge
Sink
Sheep Run
Straight Creek
Rangle Run
Myers Hol
Levanna Branch
OHIO RIVER
BRACKEN COUNTY, KENTUCKY
52
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 52




53
N
(Joins sheet 57)
(Joins sheet 52)
(Joins sheet 54)
(Joins sheet 57)
1 630 000 FEET
1 665 000 FEET
J E F F E R S O N
U N I O N
B Y R D
Redoak
Redoak
Creek
Hartman Road
Sealer Road
Gardner Road
Herrmann Road
Mt Aire Road
Brown
Chicken Lick Road
Indian Lick Road
Cluxton Road
Hollow Road
Bernard Schwallie Road
Chicken
Lafferty Run
Lafferty Road
Lick
Indian
West Fork
West Fork Road
Eagle Creek
Eagle
Creek
Hollow
Road
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
1
0.5

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 54



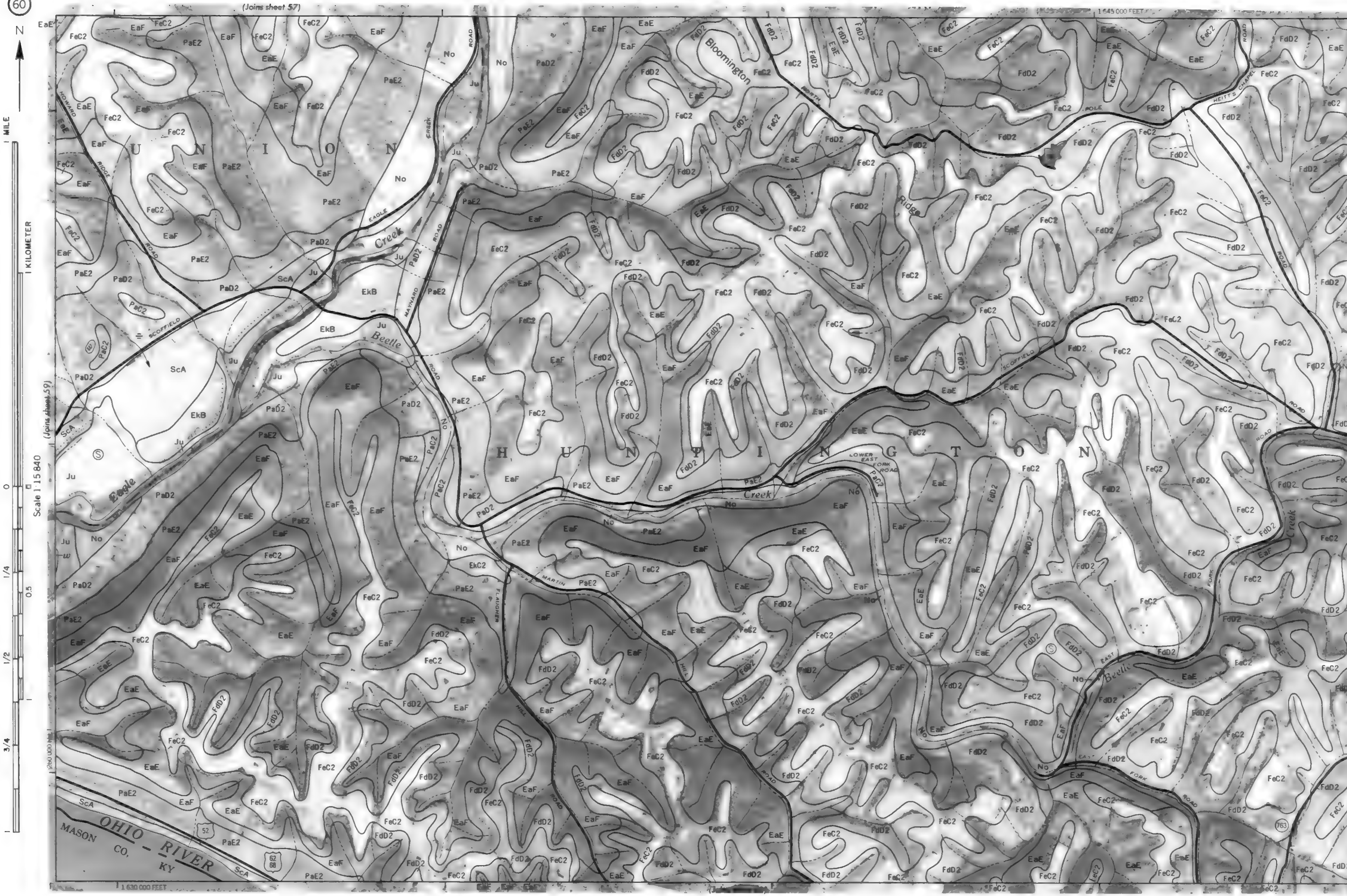
SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 55


56
N
(Joins sheet 52)
(Joins sheet 55)
(Joins sheet 57)
(Joins sheet 59)
1 625 000 FEET
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1
UNION
Stringtown
Howard
Ridge
Mefford
Hollow
Kope Hol
Run
Cornick
Redoak
Creek
Chicken Creek
Hollow
OHIO RIVER
MASON COUNTY, KENTUCKY
RIPLEY
STRINGTOWN ROAD
RANKIN ROAD
CORNICK RUN ROAD
SCHWALLIE
RIPLEY ROAD
NORTH ROAD
TRAPP HOLE
KINKEAD ROAD
HOWARD RIDGE
DEVORE RD
HOWARD HILL ROAD
DUMP ROAD
52
62
68
EaE
EaF
LoB2
PaE2
RpB
RpC2
FdD2
FeC2
JeD2
No
Ju
EkB
EkC2
ScA
BoD2
CkF

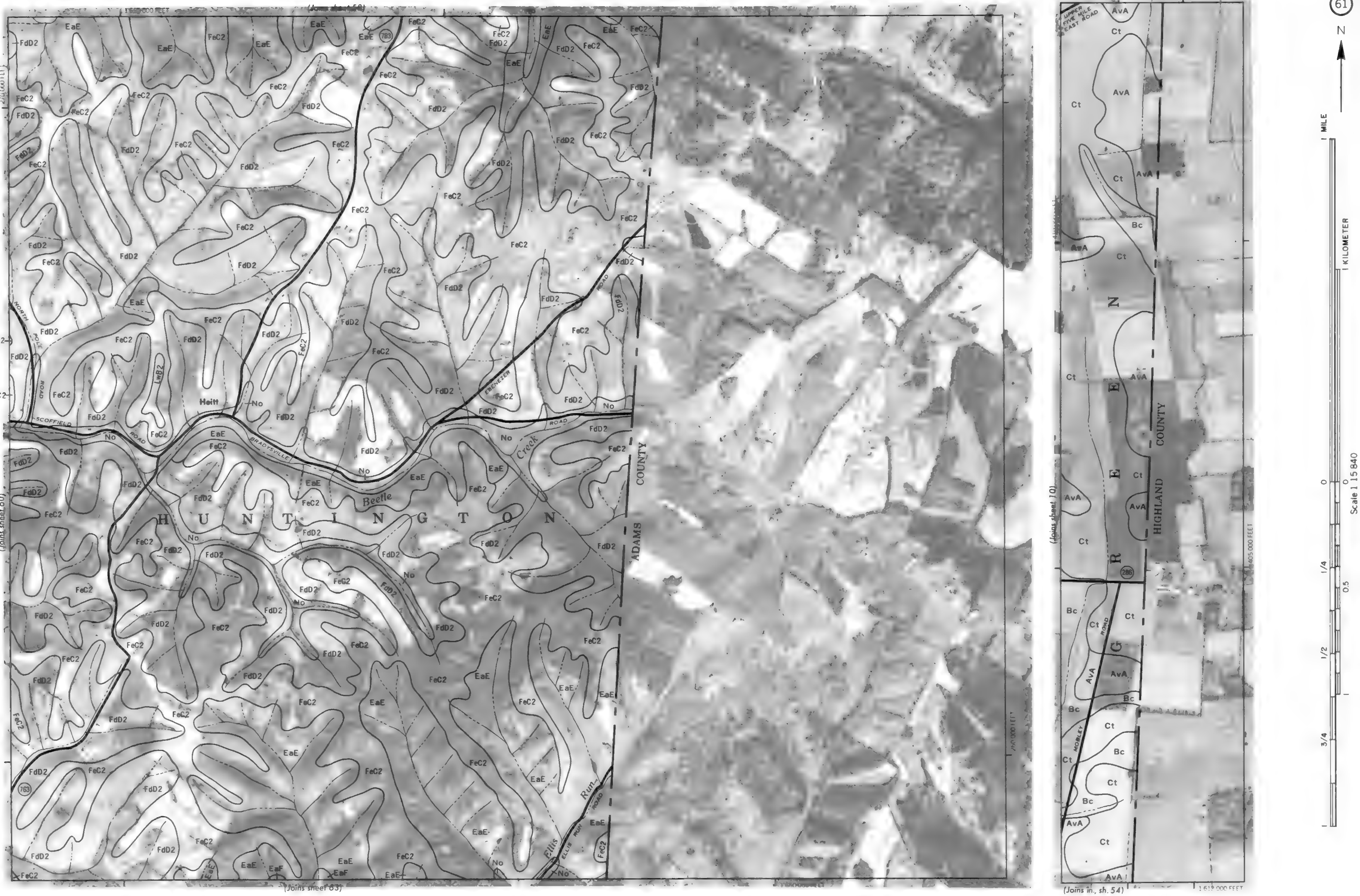

(Joins sheet 53)
(Joins sheet 56)
(Joins sheet 58)
(Joins sheet 60)
1 630 000 FEET
N
1 MILE
1 KILOMETER
Scale 1 15 840
0
1/4
1/2
3/4
0.5
U N I O N
H U N T I N G T O N
BYRD
FOX HOLLOW ROAD
CHICKEN HOLLOW ROAD
LAFFERTY ROAD
Lafferty Run
Indian Lick
Fox Hollow
Eagle Creek
EAGLE CREEK ROAD
Brushy Fork
Creek
Ghost Hollow
Hollow
Bloomington Ridge
Porter Ridge
Porter Hollow
PORTER ROAD
McKEE ROAD
NORTH POLE ROAD
UPPER NO
WILES ROAD
HICKORY RIDGE ROAD
CREEK ROAD
KINKEAD
ROAD
RpB
RpC2
JeD2
FdD2
FeC2
EaE
EaF
LoB2
PaE2
PaD2
No
Ju
SaB
ScA
WvB

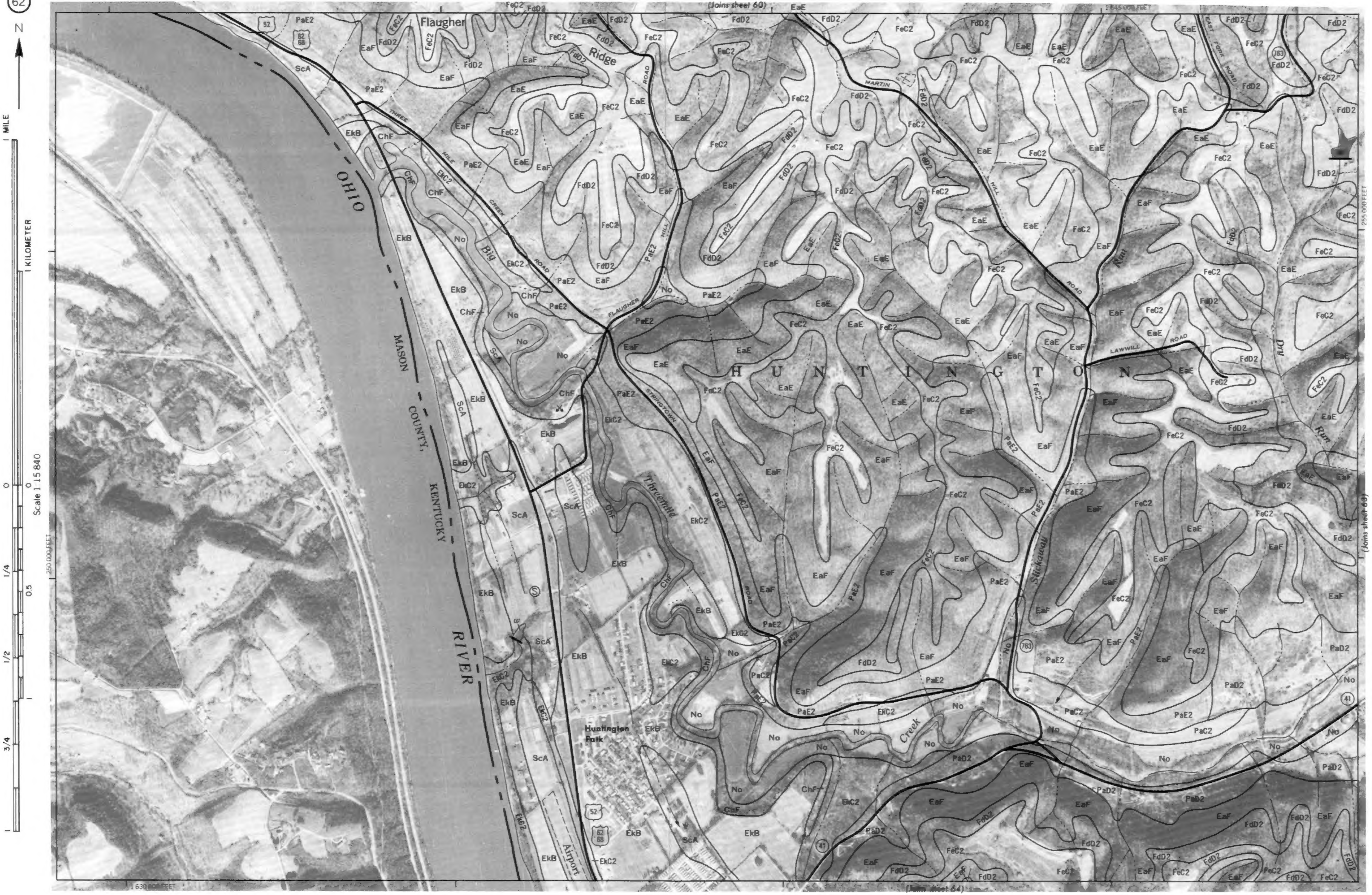
SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 58

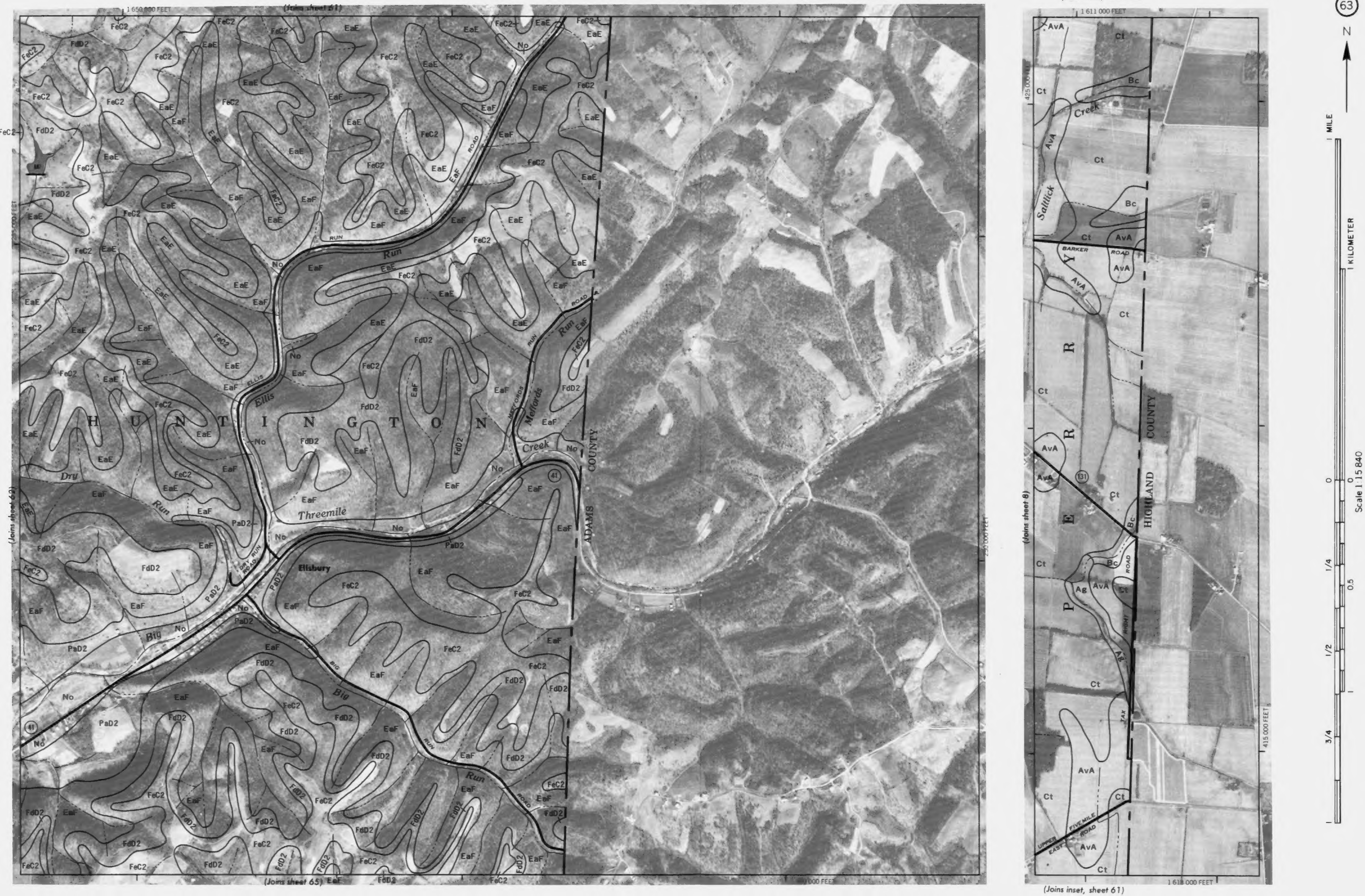

(Joins sheet 56)
(Joins sheet 60)
1 610 000 FEET
1 625 000 FEET
260 000 FT
RIPLEY
OHIO
RIVER
MASON
COUNTY,
KENTUCKY
U N I O N
Eagle
Creek
Cedar
Hill
HUNTINGTON
Logan
Gap
SCOFFIELD
STEPHENSON
ROAD
ELK
RIVER
CAMPBELL
HOWARD
HILL
LOGAN
GAP
52
62
68
EkB
EkC2
PaE2
PaD2
EaF
EaE
FeC2
FdD2
ChF
No
ScA
Ju
N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
0.5
1/2
3/4
1

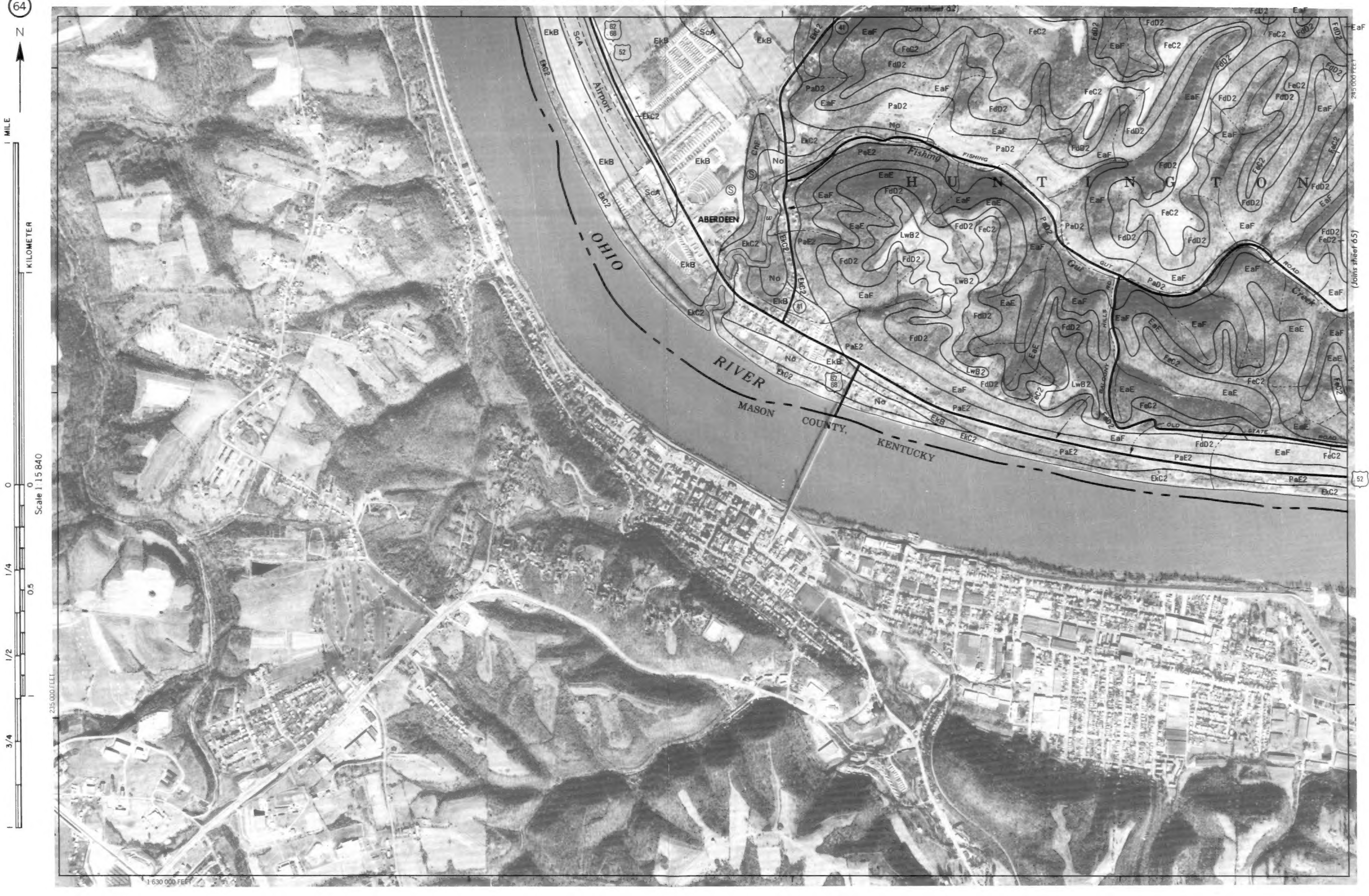

60
N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
0.5
1/2
3/4
(Joins sheet 57)
(Joins sheet 59)
(Joins sheet 61)
1 645 000 FEET
1 630 000 FEET
250 000 FEET
U N I O N
H U N T I N G T O N
Bloomington
Ridge
Eagle
Creek
Beetle
LOWER EAST FORK ROAD
EAST FORK ROAD
SCOFFIELD ROAD
HEITT'S CHAPEL ROAD
HOWARD RIDGE ROAD
MAYNARD ROAD
EAGLE CREEK ROAD
FLAUGHER HILL ROAD
MARTIN
NORTH POLE
OHIO RIVER
MASON CO., KY
52
62
68
763

# SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 61




(Joins sheet 60)
(Joins sheet 63)
(Joins sheet 64)
N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
1 645 000 FEET
255 000 FEET
250 000 FEET
1 630 000 FEET
Flaugher
Ridge
OHIO
RIVER
MASON
COUNTY,
KENTUCKY
H U N T I N G T O N
Huntington Park
Airport
Big
Threemile
Creek
Suckaway
Dry
Run
THREE MILE CREEK ROAD
FLAUGHER HILL ROAD
MARTIN HILL ROAD
STRINGTOWN ROAD
LAWWILL ROAD
EAST FORK ROAD
52
62
68
763
41


(Joins sheet 61)
1 650 000 FEET
(Joins sheet 62)
(Joins sheet 65)
H U N T I N G T O N
ADAMS COUNTY
Ellsbury
Threemile
Dry Run
Big Run
Ellis
Meffords Creek
(Joins inset, sheet 65)
1 611 000 FEET
425 000 FEET
415 000 FEET
Saltlick Creek
BARKER ROAD
P E R R Y
HIGHLAND COUNTY
(Joins sheet 8)
UPPER EAST FIVE MILE ROAD
(Joins inset, sheet 61)
1 618 000 FEET
N
1 MILE
1 KILOMETER
Scale 1:15 840


64
N
1 MILE
1 KILOMETER
Scale 1:15 840
OHIO
RIVER
MASON
COUNTY,
KENTUCKY
ABERDEEN
H U N T I N G T O N
Fishing
Gut
Creek
Airport
(Joins sheet 65)
EkB
ScA
EkC2
No
EaF
FeC2
FdD2
PaD2
PaE2
EaE
LwB2

SOIL MAP OF BROWN COUNTY, OHIO — SHEET NUMBER 65